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GPS Functions Deployment Guide

(For internal use only)

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Key words: BTS3012, DGPS, deployment

Abstract: This guide describes the hardware components of BTS3012 GM51DGPS and the procedures for locating and solving deployment problems on site. This guide helps the engineers with basic knowledge about GSM BTS add boards, upgrade version, locate problems, and trace messages independently. It helps engineers effectively complete GM51DGPS deployment.

Abbreviations

Abbreviation	Full Spelling
1PPS	1 Pulse Per Second
A	
Abis	
BTS	Base Transceiver Station
BSC	Base Station Controller
DATU	Antenna and TMA Control Unit for DTRU BTS
DAFU	Antenna Front-end Unit for DTRU BTS
DCCU	Cable Connection Unit for DTRU BTS
DCOM	Combining Unit for DTRU BTS
DCMB	Common Module Backplane for DTRU BTS
DCSU	Combined_cabinet Signal connection Unit for DTRU BTS
DDPU	Dual Duplexer Unit for DTRU BTS
DGPS	GPS Processing Unit for DTRU BTS
DTMU	Transmission & timing & Management Unit for DTRU BTS
DTRB	DTRU Backplane
DTRU	Double TRansceivers Unit
EGSM	Extended GSM
GLONASS	GLObal NAvigation Satellite System
GPRS	General Packet Radio Service
GPS	Global Position System
MS	Mobile Station

Abbreviation	Full Spelling
MSC	Mobile-service Switching Center
OMC	Operations & Maintenance Centre
PCU	Packet Control Unit
RGPS	Remote GPS
SDH	Synchronous Digital Hierarchy
Um	

Glossary:

Double-transceiver: a module carries two carriers.

PBT: a power boost technology.

Tx diversity: a method to realize the man-made multi-path which optimizes the downlink signals.

Four-way Rx diversity: a technology in which signals are received in four routes, which can gain more uplink diversity gain than the main diversity.

Sidepower: a thin and tall power cabinet which takes little space and stands by the side of equipment.

RF front-end: the combining and dividing unit and duplexing unit, such as DDPU, DCOM, CDU, SCU, and EDU.

GPS Functions Deployment Guide

1 Introduction to GM51DGPS Board

1.1 Introduction to GPS Functions

At present, two global positioning systems are widely used on the world: GPS and GLONASS. The GPS is a satellite navigation system using radio signals under all kinds of weather. It can identify the 3-dimension position, velocity, and time. The GLONASS, developed by Soviet Union and further developed by Russia, is also a satellite navigation system. The GLONASS is similar with the GPS developed by USA, but its coverage range is smaller.

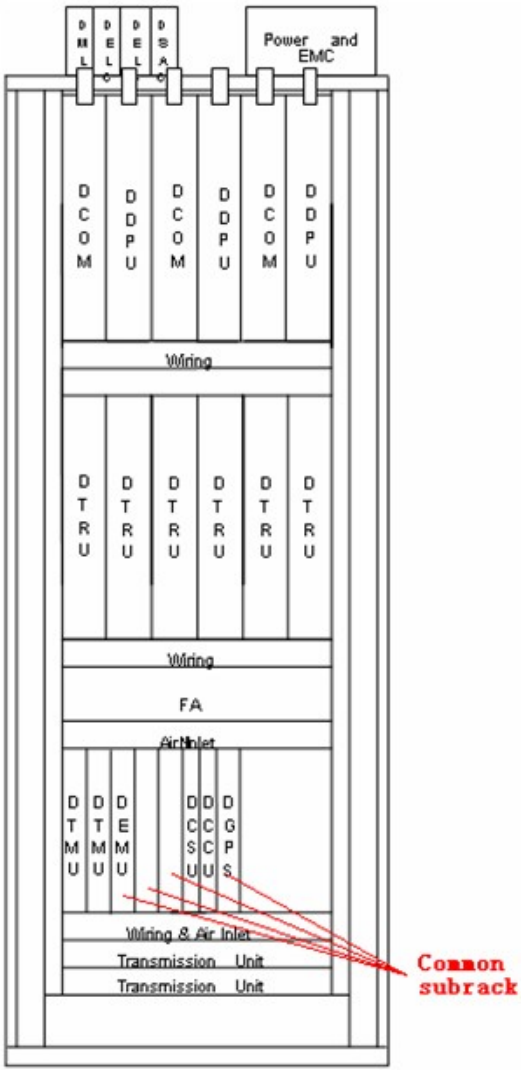
The BTS3012/BTS3012AE implements clock synchronization with timing function of GPS/GLONASS. The timing signal of GPS/GLONASS is stable with permanent frequency stability. The BTS uses high-stability oscillator with instant stability, with which the permanent frequency stability ensures stable and reliable clock for GSM system.

The DGPS board of the BTS3012 supports GPS/GLONASS dual-satellite synchronization mode, so the BTS3012 can provide the customer with two synchronization modes: GPS and GPS/GLONASS. The DGPS board is used in non-RGPS and RGPS scenarios. The configuration depends on on-site requirements. For details, refer to Configuration of the DGPS Finished Board. The RGPS scenario exists only in swapping competitor’s BTSs.

1.2 Position of GM51DGPS in the Whole BTS

The GM51DGPS board can be installed in the common slots of common subrack on the BTS3012, as shown in Figure 1.1. The board implements synchronization of BTSs on the whole GSM network. It also provides accurate clock reference source and time signals for other co-cabinet equipment.

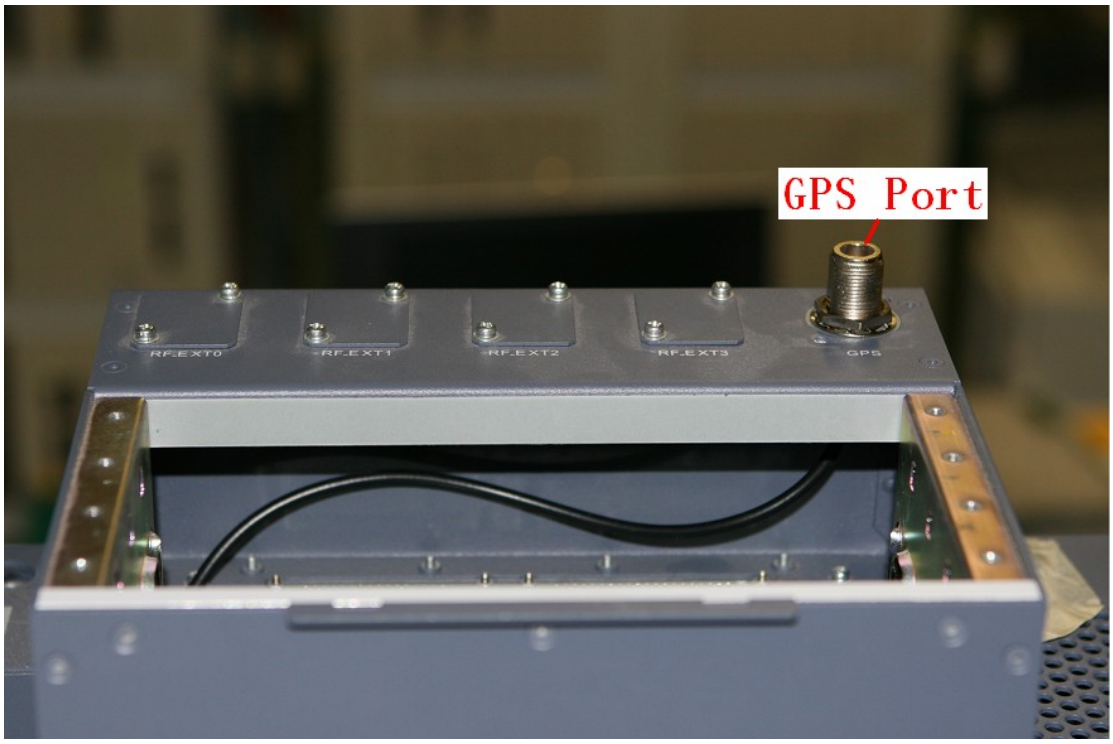
Figure 1.1 Position of GM51DGPS in the Whole BTS



1.3 GPS Port on the Top of Cabinet

Figure 1.2 shows the GPS port on the top of cabinet.

Figure 1.2 GPS Port on the Top of Cabinet on BTS3012



Install the cable connected to the GPS port on site. For the installation method, refer to *BTS3012 Hardware Description* and *BTS3012 Installation Guide*. Table 2.1 lists the description of GPS cable.

Table 2.1 Description of GPS cable

Code	Description
04047637	Single Cable, RF Cable,2.2m,SMA50AM-IV,SYV50-2.2/0.68B,N50SF-III,BTS3606

1.4 Dimensions

The dimensions of the GM51DGPS board is 298 mm x 233.3 mm x 29.9 mm (height x width x depth).

The GM51DGPS board weights about 0.7 kg.

1.5 Power Consumption

The maximum power consumption of GM51DGPS board is 6 W, which varies with the used GPS card.

1.6 Surge Protection Class

There are three ports (ANT port, COM port, and RGPS port) and a test port (1PPS port) on the panel of DGPS board. For details refer to Description of the Ports on the DGPS Board. The test port is used in laboratory test only, so Electrostatic Discharge (ESD) protection is considered without requirements on surge protection. Table 2.2 lists the surge protection class for the DGPS board.

Table 2.2 Description of surge protection class of DGPS board

Board silkscreen	Port Type	Surge Protection Class
ANT	SMA	After the lightning arrester is installed on the top of cabinet, the surge protection class is 8 kA in differential mode and 40 kA in common mode.
TX+, Tx-, and so on	Wiring Terminal Block	Differential mode: 3 kA; common mode: 5 kA
COM	RJ45	250 A

1.7 Functions of the DGPS Board

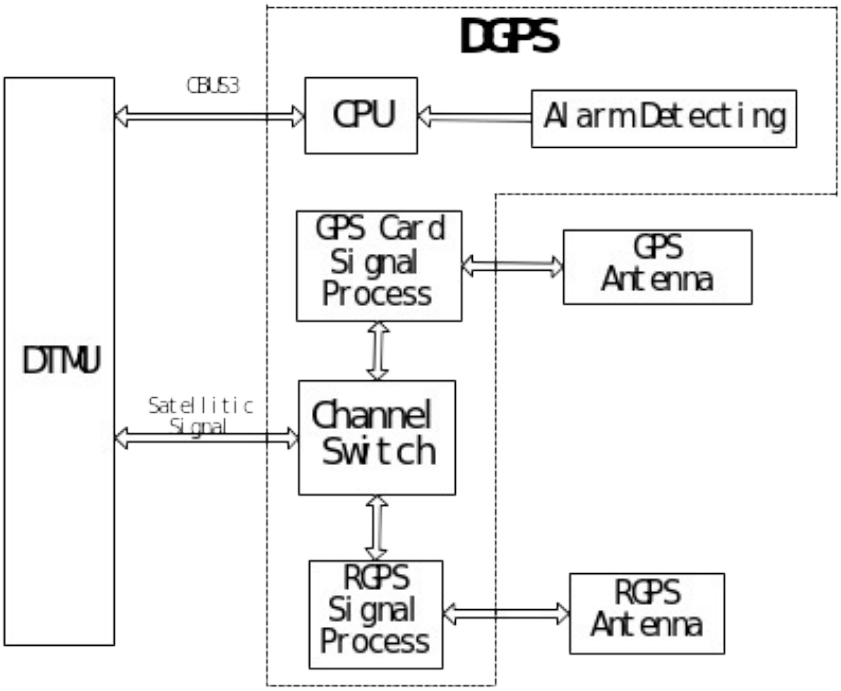
The DGPS board implements the synchronization of macro BTS3012 on the whole GSM network. It receives GPS/GLONASS signals from satellites and provides accurate clock reference source and timing signals. The DGPS board can provide differential 1PPS pulse signals and time signals for other BTSs.

The DGPS board features the following functions:

- Transfer the time signals and 1PPS signals between the DGPS board and the DTMU board.
- Receive the time signals and 1PPS signals from the GPS card or RGPS antenna.
- Monitor the status of the DGPS board and collect alarms.

Figure 1.3 shows the working principles of the DGPS board.

Figure 1.3 Working principles of DGPS board



The DGPS board consists of the following parts:

1.7.1 CPU

The CPU exchanges the information with DTMU (reporting alarms, querying working status, and software upgrade), collects monitoring information about alarms on the DGPS board, controls the channel switch according to the configuration of the DTMU board.

1.7.2 Monitoring Alarms on the DGPS Board

Monitoring alarms on the DGPS board consists of collecting information about temperature, voltage, and current, and monitoring and reporting the working status (normal, short circuit, overcurrent, and undercurrent) of each part on the board.

1.7.3 GPS card Processing Part

The GPS card processing part consists of supplying power to GPS receiver module and GPS/GLONASS receiver module, controlling the power supply to the GPS antenna, receiving the GPS signals, and converting the serial signal level.

1.7.4 RGPS Processing Part

The RGPS processing part consists of controlling the power supply to RGPS antenna and converting serial signal level.

1.7.5 Channel Switch

The channel switch refers to controlling the Tx/Rx channel of DTMU so that the Tx/Rx channel can connect to the Tx/Rx port of GPS card or RGPS processing part.

The hardware of the DGPS board works as follows:

- The software on the DGPS board collects temperature information from the temperature sensor on the DGPS board. It collects 5 V and 12 V voltage information from the analog-to-digital convertor. It reports the two kinds of information to the DTMU board.
- The RGPS board and the GPS card are not used at the same time. In addition, they must share the serial channel between them and the DTMU. Therefore, before using them, select and switch the serial channel. For details, refer to lStep 5

When the DGPS board works in the RGPS mode, its software turns on the switch of supplying 12 V power to RGPS antenna, switches the serial channel between the DGPS board and the DTMU board to the RGPS processing part. After the DTMU board completes the initialization with the RGPS antenna through transparent transmission by the DGPS board. The RGPS antenna reports the time information timely. The DTMU processes (calculating and adjusting the frame number) the time information from the DGPS board. When the DGPS board works, its software collects the information about the working current of the RGPS antenna and reports the working status (normal, short circuit, overcurrent, and undercurrent).

When the DGPS board works in the GPS card mode, its software turns on the switch of supplying 5 V power to GPS card antenna, switches the serial channel between the DGPS board and the DTMU board to the GPS card processing part. After the DTMU board completes the initialization with the GPS card through transparent transmission by the DGPS board. The GPS card reports the time information timely. The DTMU board processes (calculating and adjusting the frame number) the time information from the DGPS board. When the DGPS board works, its software collects the information about the working current of the GPS antenna and reports the working status (normal, short circuit, overcurrent, and undercurrent).

1.8 Configuration of the DGPS Finished Board

Table 3.1 lists the configuration of the DGPS finished board.

Table 3.1 Configuration of the DGPS finished board

Code	Description	Application Scenario
03030JCL	BTS3012, GM51DGPS2, GPS Processing Unit for DTRU BTS, with RT	Select the type according to the application scenario. The 03030JCL is recommended. Wherein, the RT GPS card and M12M GPS card are GPS receiver module, supporting GPS only; The K161 GPS card is GPS/GLONASS receiver module, supporting both GPS and GLONASS. When the DGPS board is used in Russia, it must be equipped with the K161 GPS card.
03030ERJ	BTS3012, GM51DGPS3, GPS Processing Unit for DTRU BTS, with M12M	
03030JCM	BTS3012, GM51DGPS1, GPS Processing Unit for DTRU BTS, with K161	
03030JTU	BTS3012,GM51DGPS4,GPS Processing Unit for DTRU BTS,with RGPS	The RGPS is used in swapping competitor’s equipment when there is RGPS module existing in the original BTS system

The antenna system varies with the finished board. For details, refer to BOM List of DGPS Antenna System

2 Hardware Installation and Operation Guide in Deployment

2.1 Hardware Installation Guide

2.1.1 Installing Boards

The GM51DGPS board is installed in the common slots 2 to 4, and 7 in the common subrack of cabinet. The GM51DGPS is optional. Its full configuration is one board; namely, only one DGPS board can be installed on a site. For detailed installation guide, refer to *BTS3012 Hardware Description* and *BTS3012 Installation Guide*.

2.1.2 Installing the Antenna System

The DGPS antenna system is categorized into the RGPS antenna system and the GPS/GLONASS antenna system according to application scenarios. For detailed installation guide, refer to *Base Station Satellite Antenna System Installation Guide*.

The following paragraphs describe the installation of two antenna systems respectively.

Installing the RGPS Antenna System

The RGPS antenna system is reused in swapping competitor’s BTSs, so the installation is simple. Just lead the signal from the competitor’s surge protection box to the DGPS board. In this configuration, Huawei needs not to deliver any materials of antenna system.

For the connection between RGPS feeders and the DGPS board, refer to Description of the Ports on the DGPS Board. Turn off the power before installing cables. Pay attention to the matching relationship between cables.

The competitor has installed surge protection equipment, so no special operations are required in reuse.

In swapping, if the competitor’s RGPS antenna is at least 40 m away from the equipment room, read the input voltage of receiver on the LMT after powering on the DGPS board and configuring the RGPS antenna system. For details, refer to IStep 5. If the read voltage is smaller than 8 V, shorten the distance between the RGPS antenna and the equipment room so that the read input voltage of receiver can be greater than 8 V.

Installing the GPS/GLONASS Antenna System

The GPS/GLONASS antenna system consists of GPS/GLONASS antenna, feeder, lightning arrester, and accessories. If the BTS has to share the antenna system with other BTSs, install a GPS power splitter. For details, refer to BOM List of DGPS Antenna System. For the installation of each part, refer to *Base Station Satellite Antenna System Installation Guide*. The following paragraphs describe the installation precautions.

1. Precautions of Installing the Antenna

   Table 1.1 lists the antenna for the DGPS board.

Table 1.1 Antenna for the DGPS board

Code	Description	Application Scenarios
27010596	Antenna,1575.42 +/-1.023MHZ,38dBi,Right Circularly Polarized,Omni,0W,0 Deg-N/Female,No rack	The antenna is used with GPS receiver module. For finished boards: 03030ERJ and 03030JCL
99049768	Antenna, 1575.42~1611MHz-GPS/LONASS-360Deg-0.15W-TNC Female,No rack	The antenna is used with double-satellite card. The code of corresponding finished board is 03030JCM.

   - Select the position for installing the antenna carefully. For details, refer to *Base Station Satellite Antenna System Installation Guide*.
   - Install the antenna away from strong radiation and interference.
   - Install the antenna where there are surge protection and waterproof measures.
   - After installing the antenna and feeder, use a multimeter to determine whether there is short circuit between core conductor and grounding shield at the end of feeder on the cabinet side.

2. Precautions of Installing Feeders

   Table 1.1 lists the principles for selecting feeders.

Table 1.1 Principles for selecting feeders

Distance Between the Antenna and the BTS	Feeder Code	Description	Remarks
< 70 m	25070009	Coaxial Cable,1/2.74mm 50ohm,10.16mm,7.24mm,0mm,International type:RG-8U	If the feeder is within 70 m, select 25070009. If the feeder is longer than 70 m, select it accordingly.
70–100 m	25070076	RF Cable,Copper-clad Aluminium Wire,50ohm,13.5mm,8.7mm,3.55mm,Black,1/2-Inch	
100–300 m	25070133	Coaxial Cable,Smooth Copper Tube,50ohm,27.8mm,21.5mm,9.3mm,Black, 7/8" Aluminium Cable	
> 300 m	25070018	Coaxial Cable,Smooth Copper Tube,50ohm,39.4mm,32.2mm,13mm,Black	

Take the following precautions in installing feeders:

- The 7/8 inch feeder or 5/4 inch feeder is not delivered by default. If the on-site engineers require them, highlight this.
- The antenna support, especially the fastening bolts, the expansion bolts, and the area around the bolts and holes, should be applied with antirust paint after the installation.
- Waterproof the outdoor connectors of GPS antenna system with two layers of waterproof tapes and one layer of waterproof clay. The waterproof tape must fully cover the heat-shrinkable tube at the connectors of jumper.
- Grounding the feeder is not required by the current surge protection principles.
- The delay in transmitting signals on the feeder is present, which brings error to the system. therefore, compensate the delay on the feeder in system configuration. For details, refer to IStep 5.
- Do not connect the antenna and feeder to the cabinet after installing them. Use a multimeter to determine whether there is short circuit between the core conductor and grounding shield of feeder on the cabinet side. If there is short circuit, locate the position of short circuit (on the antenna or at the conjunction part between the antenna and the feeder).

3. Precautions of Installing the Lightning Arrester

   One PCS of lightning arrester (without grounding terminal) is configured for surge protection of the device in the cabinet (surge protection at the antenna is not necessary) by default.

Table 1.1 lists the description of lightning arrester.

Table 1.1 Description of lightning arrester

Code	Description
19020126	Antenna Feeder Arrester,8KA,Residual Voltage 15V,1200~1600MHz,100W,N-M/N-F,Long Connector

Figure 3.2 shows the installing the lightning arrester on the BTS3012.

Figure 3.2 Installing the lightning arrester

The lightning arrester is grounded through the connection of conversion cable of GPS antenna and the cabinet housing. Therefore fasten the fixing hex nut of N female connector of the conversion cable for secure grounding in installation.

For BTS3012AE cabinet, the installation of lightning arrester is described as following:

I. BTS3012AE has two GPS holes, each GPS hole has two iron covers on it, one with N-Female hole (shown in figure 2-2, yellow iron cover) for arrester installation and the other without hole (not shown in figure 2-2) for seal if nothing installed.

II. Unfasten the four screws (countersunk head) to take off the iron cover without N-Female hole. We just need one GPS hole, so leave the other GPS hole untouched. After taking off the iron cover without N-Female hole, fastening the four screws back to fix the iron cover with N-Female hole. After finishing this, you will see what's shown in figure 2-2.

III. Insert the arrester's N-Female connector into the GPS hole and fasten the spring washer and hex nuts of the arrester outside (at the bottom of the cabinet) using spanner. The more tightening, the better. Figure 2-3 shows the arrester in the cabinet after all installation is finished.

Figure 3.3 GPS holes of BTS3012AE

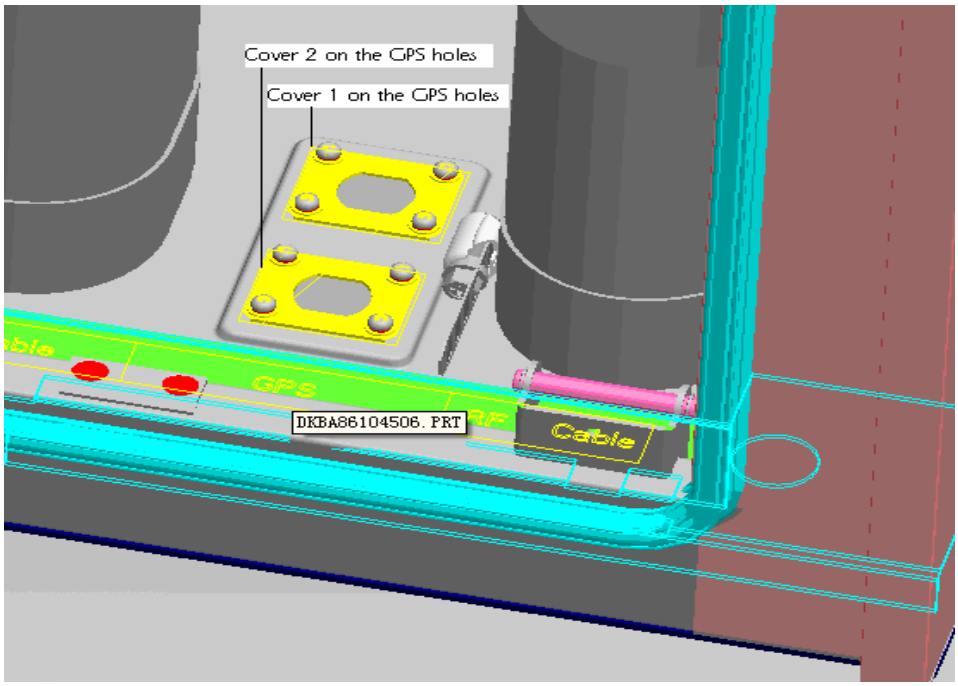
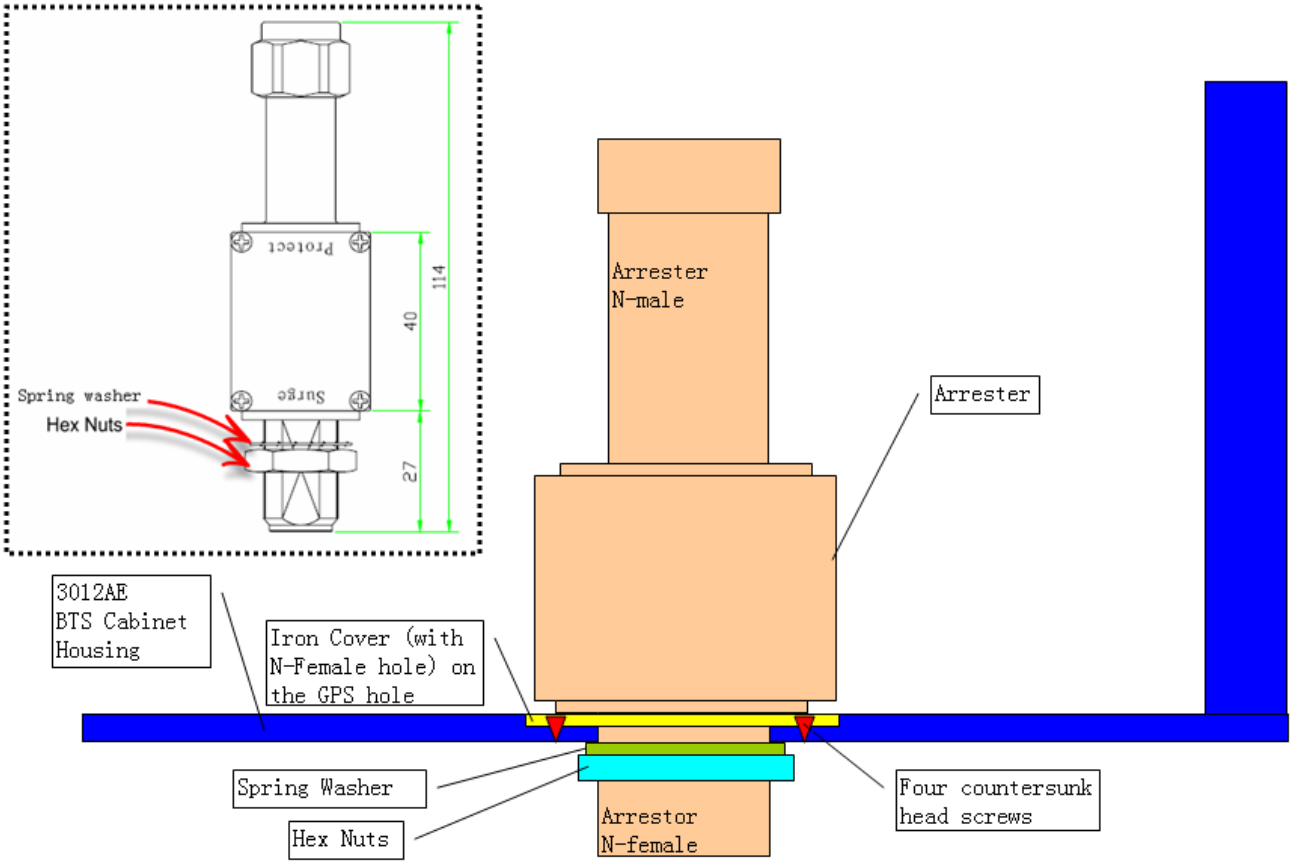


Figure 3.4 Arrester after installation



4. Installing the GPS Power Splitter and Its Precautions

   To cut the cost on the antenna system, the GPS power splitter is used to enable multiple BTSs to share one GPS antenna system. The application scenarios of GPS power splitter are as follows:

   – A GPS antenna system is present on site, such as a GPS antenna system of CDMA network of Huawei (now the software does not support sharing this kind of GPS antenna system, so this scenario can be neglected).

   – Two GSM BTSs are constructed, they share the equipment room, and they can share a GPS antenna system.

     A mandatory condition for sharing the antenna system is that the two BTSs must use the GM51DGPS finished board (using the same GPS card) of the same code. For other situations, sharing is not recommended. If the conditions are restricted and the sharing must be used, contact R&D engineers first.

     Table 1.1 lists the specifications of GPS power splitter (27020082).

Table 1.1 Specifications of GPS power splitter (27020082)

Module Name	SL21070A
Frequency Range (MHz)	1200–1700
Input VSWR	≤ 1.2
Insertion Loss (Including Allocated Loss)	≤ 3.5 dB
Port Isolation	≥ 20 dB
Power Capability	1 W
Internal Power Loss	0.125 W (50 V)
VCC	15 V
DC Current	≥0.5 A (DC power can be supplied in both two channels)
Connector Type	GPS0: N-male ANT, GPS1: N-female
Operation Temperature	–40ºC to +85ºC
Dimension (mm) (Excluding Connector)	50 x 50 x 25
Weight (kg)	0.23

Figure 4.2 shows the outlook of GPS power splitter (27020082).

Figure 4.2 Outlook of GPS power splitter (27020082)

Install the GPS power splitter as follows:

Scenario 1:

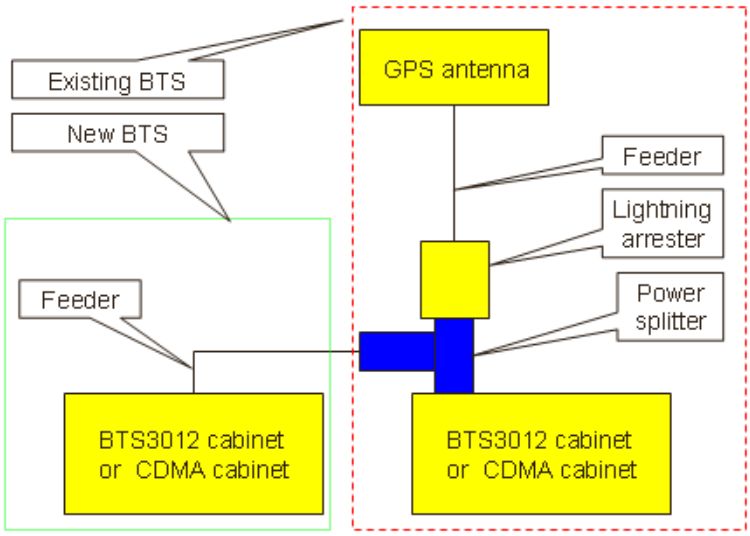
Step 1 Remove the lightning arrester of existing GPS antenna system. Connect the power splitter to the existing GPS antenna system so that it can work properly. Connect the ANT port of power splitter to the Protect port of the lightning arrester of existing GPS antenna system, the GPS0 port to the N female connector of existing GPS antenna system at the cabinet, and power splitter and lightning arrester directly to the cabinet without any jumpers.

Step 2 Connector the GPS1 port of power splitter to the N male connector of the antenna system of new BTS, the other end of feeder to the N female connector at the cabinet of new BTS.

----End

Figure 1.1 shows the sharing the GPS antenna system by BTSs in scenario 1.

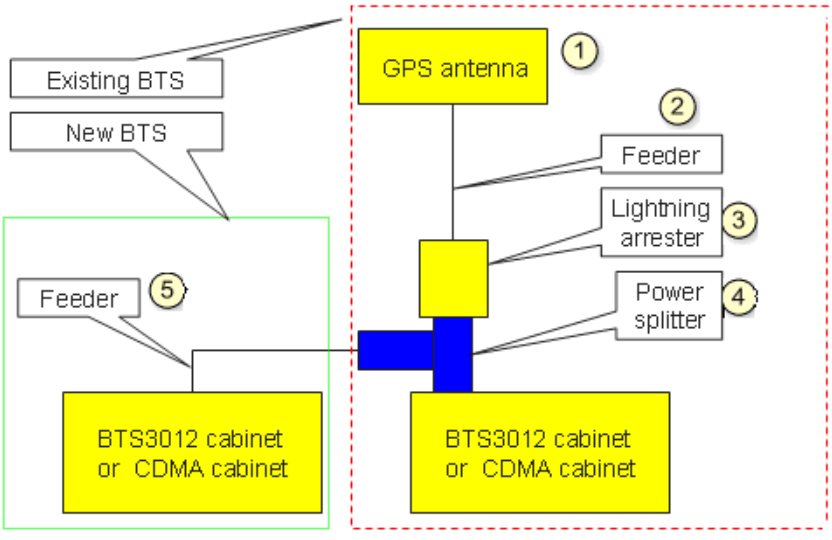
Figure 1.1 Sharing the GPS antenna system by BTSs in scenario 1



Scenario 2:

The installation method is similar to that in scenario 1, but the sequanse is 1 > 2 > 3 > 4 >5, as shown in Figure 1.2.

Figure 1.2 Sharing the GPS antenna system by BTSs in scenario 2



The GPS power splitter enables two BTSs to share a GPS antenna system, so the cost is cut (a GPS antenna, a lightning arrester, and some feeders are saved; also the installation is easier).

CAUTION

- The power splitter cannot support surge protection, so install it between the lightning arrester and the GPS port.
- Power on the two BTS sharing the GPS antenna system before configuring the DGPS board. If you power one BTS first, leaving the other BTS powered off, configuring the DGPS board of the BTS with power may lead to reporting the GPS Receiver Antenna Failure alarm.
- On an antenna-shared site, after the DGPS board is power on, set the status of antenna power supply switch correctly so that only one BTS of the two supplies power to the GPS antenna. Namely, only one of the antenna power supply switches of two DGPS boards is ON. For details about setting the switches, refer to Configuring Site Board Attributes
- On an antenna-shared site, configure the board attributes of GPS or GLONASS identically: configure the GPS receiver module to GPS; configure the two GPS/GLONASS receiver modules to either GPS or GLONASS, not any other modes.
- On an antenna-shared site, if you need to remove the GPS board from one cabinet of the two for any reason, remove the antenna from the board before removing the DGPS board; Otherwise, the other DGPS may report the GPS Receiver Antenna Failure alarm.

2.2 Guide to GM51DGPS Data Configuration

2.3 Product Version

Huawei BTS3012 DGPS board requires BSC6000 V900R008C01B050 and higher, and BTS3000V100R008C01B511 and higher.

BSC	BSC6000 V900R008C01B050
BTS	BTS3000 V100R008C01B511

2.4 Operation Guide

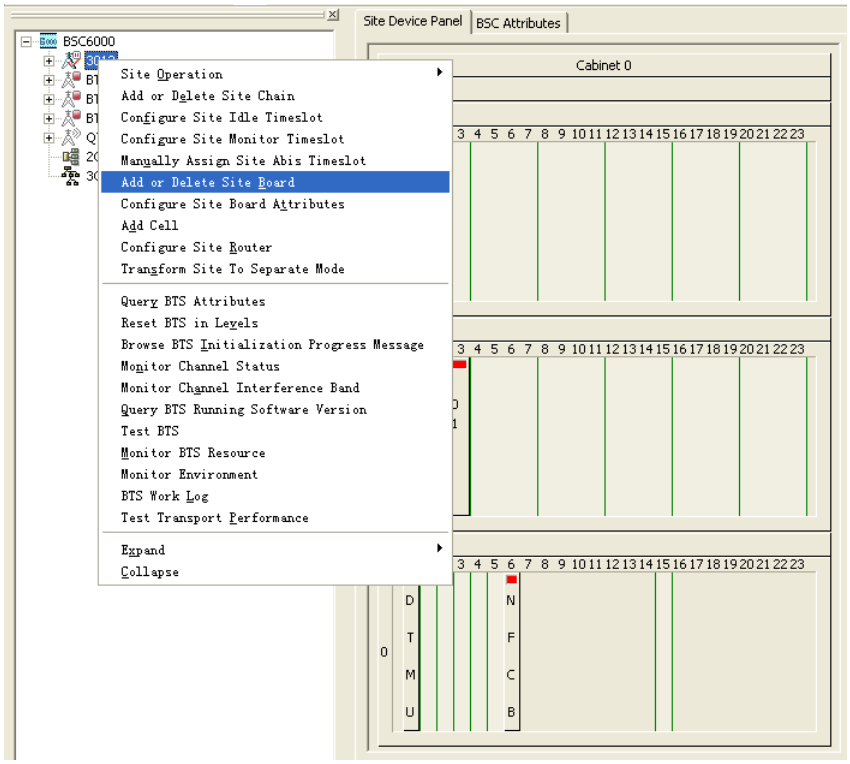
As restricted by the BSC LMT and MML, only one DGPS board can be configured on a site.

Adding the DGPS Board

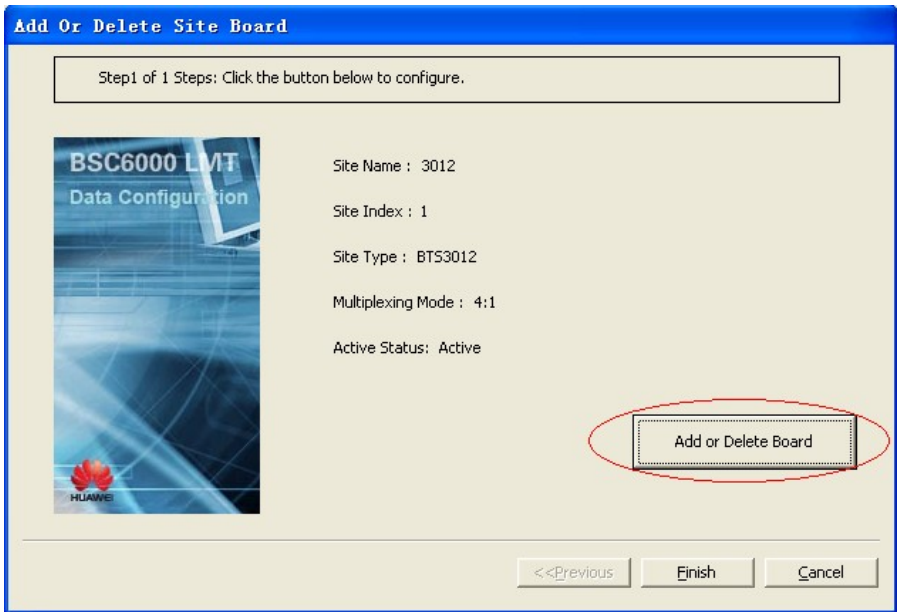
Add a DGPS board as follows:

Step 1 Log in to the BSC6000 LMT. Select the site which a DGPS board is added to, such as the site 3012 in Figure 1.1. Right-click on **3012**, and select **Add or Delete Site Board** from the shortcut menu.

Figure 1.1 Adding or deleting site board

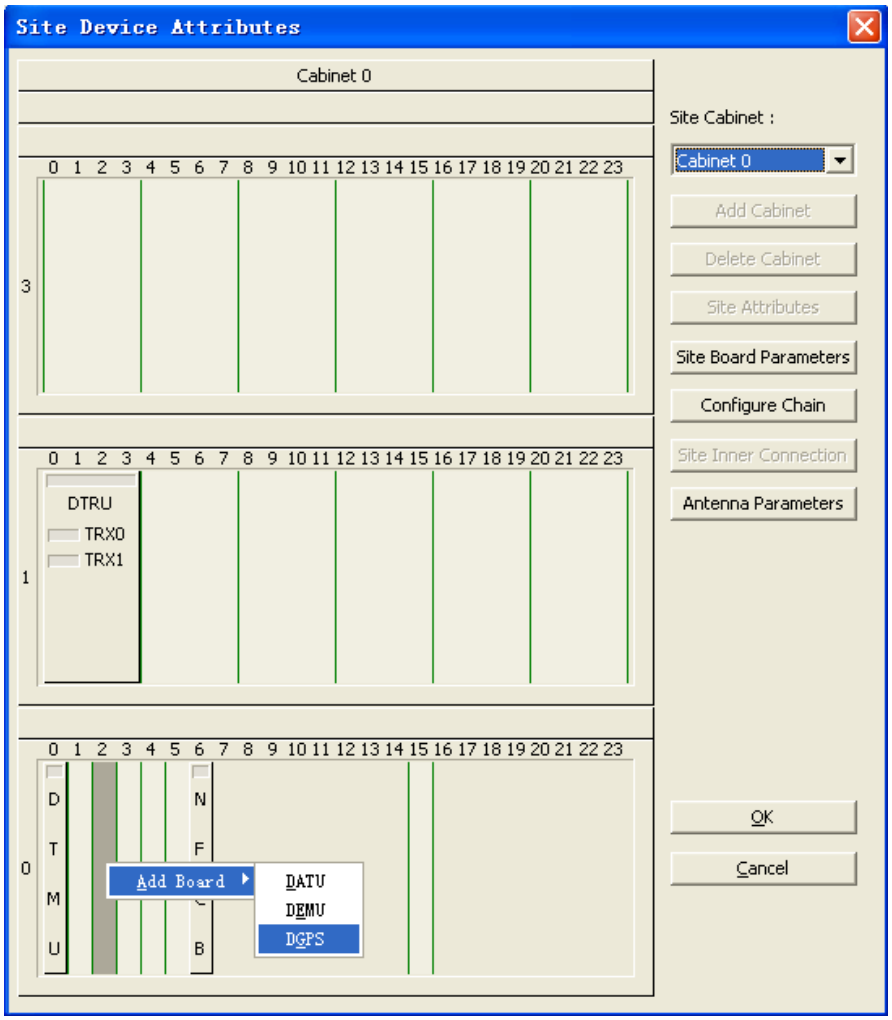


Step 2 Click **Add or Delete Board** on the **Add Or Delete Site Board** window, as shown in Step 2. Clicking the Add or Delete Board button



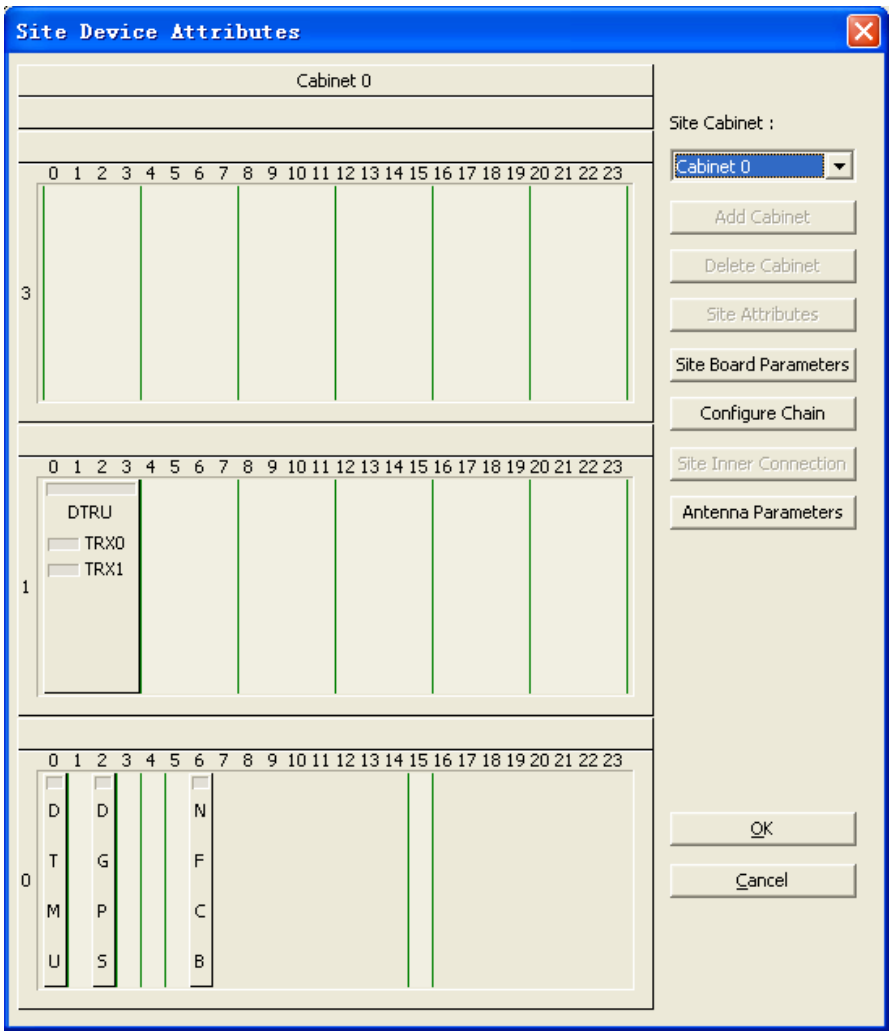
Step 3 Select an idle common slot for adding the DGPS board, as shown in Figure 1.1.

Figure 1.1 Adding the DGPS board



Step 4 Double-click the DGPS board in Figure 1.1. A window is displayed, as shown in Figure 1.2. For details, refer to Configuring Site Board Attributes.

Figure 1.1 Site device attributes



Step 5 After the configuration is complete, click OK in Figure 1.2 and return to the **Site Device Attribute** window as shown in Figure 1.1. Click OK as shown in Figure 1.1. Adding the DGPS board is complete.

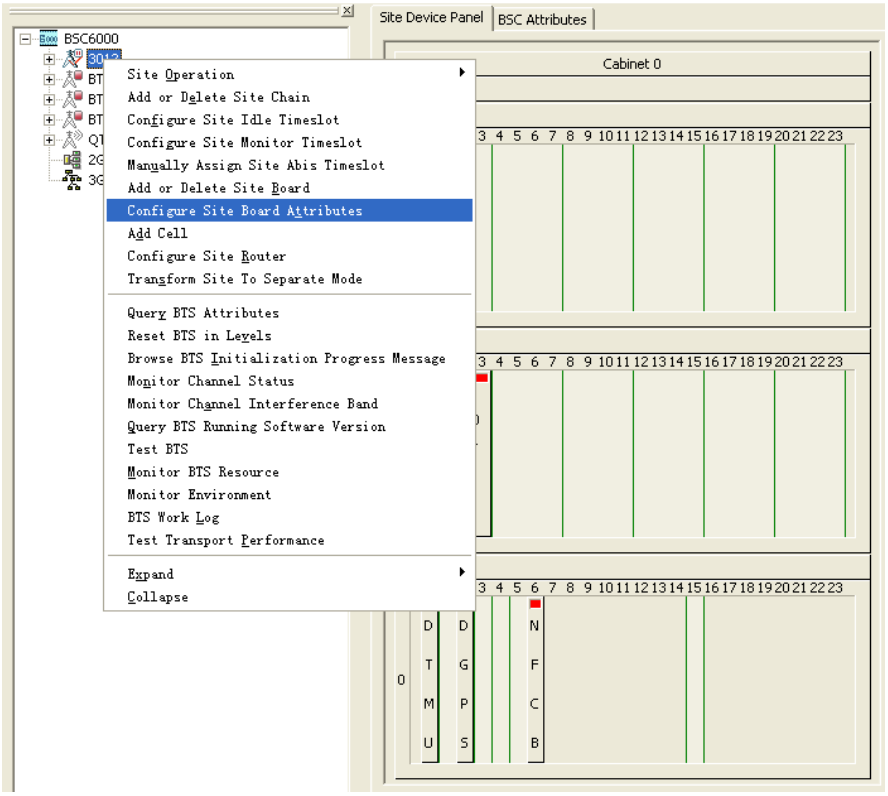
----End

Configuring Site Board Attributes

Configure the DGPS board as follows:

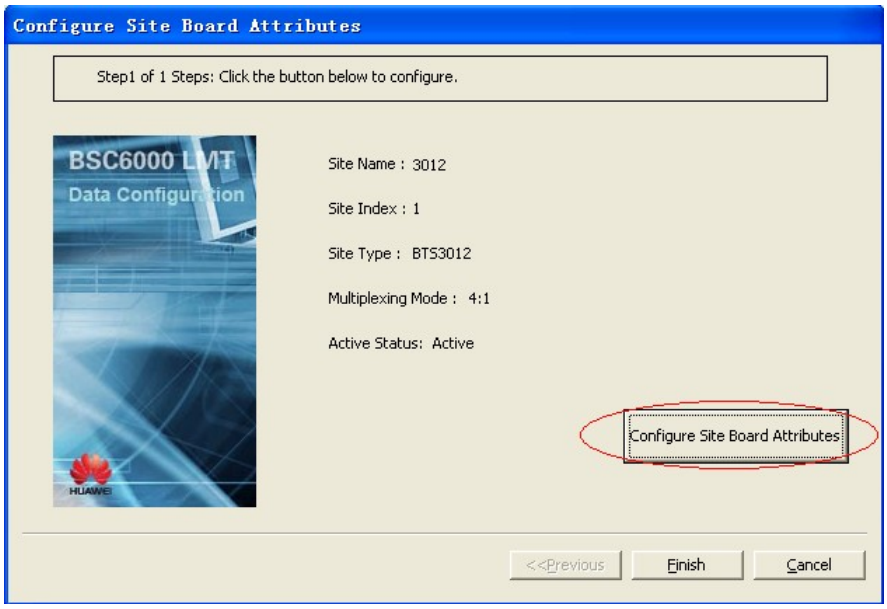
Step 1 Log in to the BSC6000 LMT. Select the site of which the DGPS board is to be configured, such as the site 3012 in Figure 1.1. Right-click on **3012**, and select **Configure Site Board Attributes** from the shortcut menu.

Figure 1.1 Configuring site board attributes



Step 2 Click **Configure Site Board Attributes** on the **Configure Side Board Attributes** window, as shown in Figure 1.1.

Figure 1.1 Clicking the Configure Site Board Attributes button



Step 3 In the **Site Device Attributes** window, right-click the DGPS board and select **Configure Board Attributes** from the shortcut menu, or double-click the DGPS board, as shown in Figure 1.1. A Basic Attributes of Site Boards dialog box is displayed, as shown in Figure 1.2.

Figure 1.1 Site Device Attributes-Configure Board Attributes

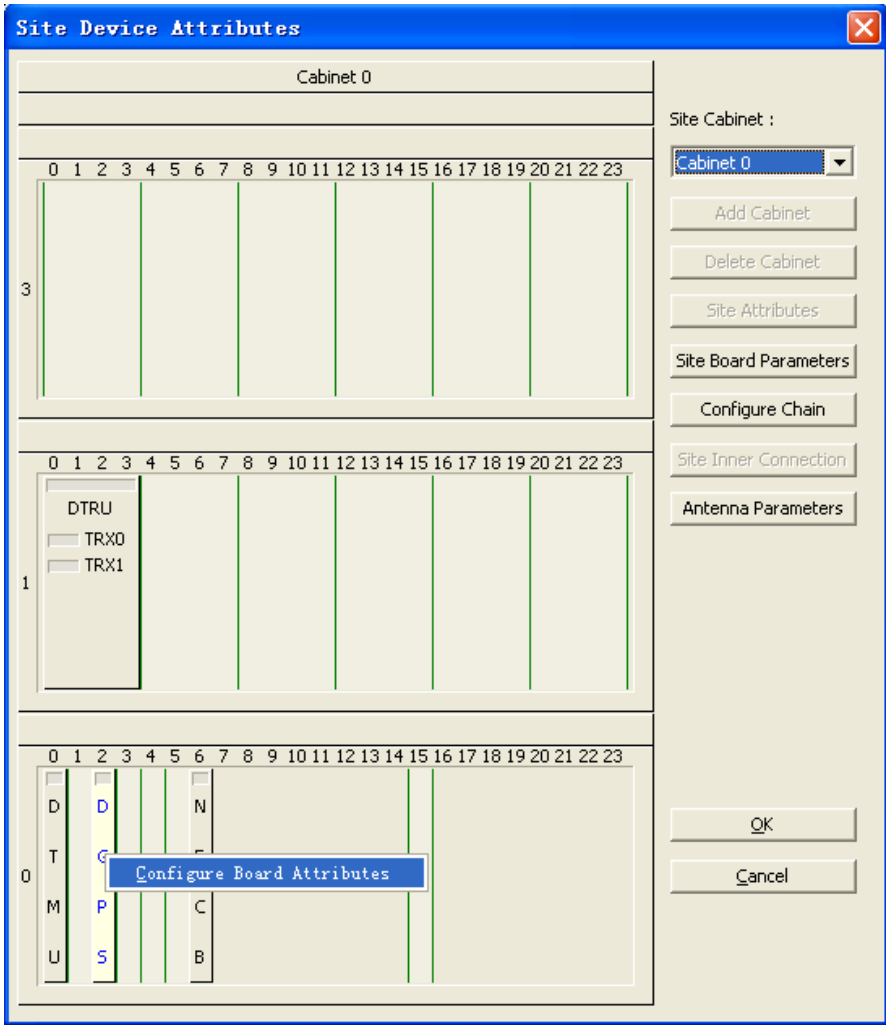
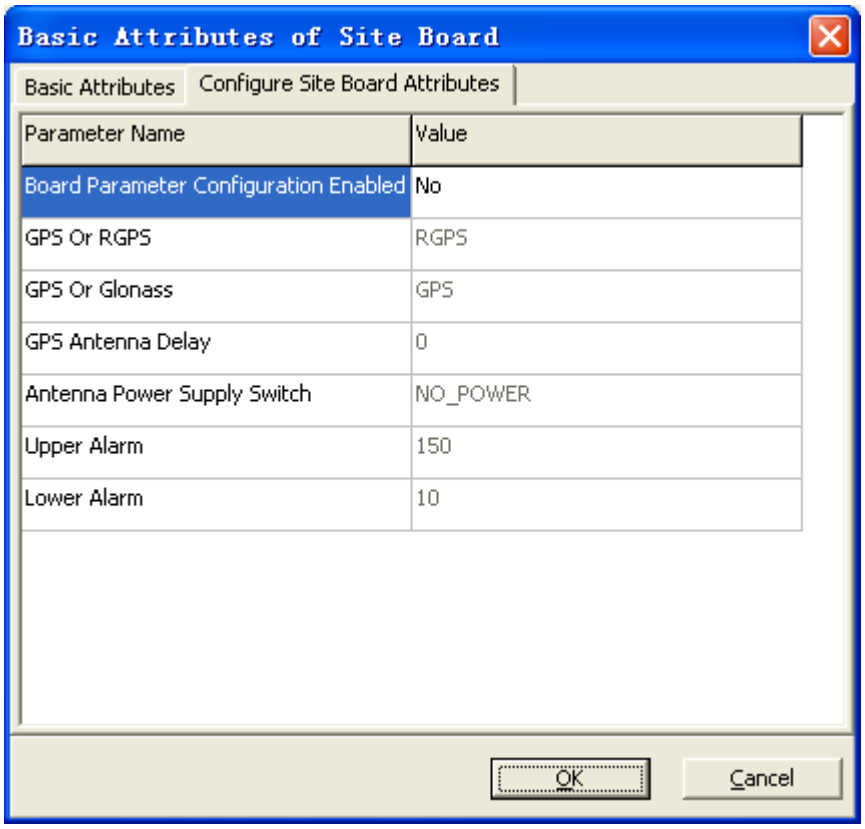


Figure 1.2 Basic Attributes of Site Board dialog box



Step 4 Click the **Configure Site Board Attributes** tab page and select **Yes** in the **Board Parameter Configuration Enabled** field box to configure the attributes of DGPS board according to actual application scenario.

- In the **GPS Or RGPS** field box, set the type of receiver to **GPS** or **RGPS**.
- In the **GPS Or Glonass** field box, set the working mode of receiver to **GPS**, **RGP**, or **GPS+Glonass**.

  Table 1.1 lists the configuration principles for receivers. For details about identifying the type of receiver, refer to 5.4.

Table 1.1 Configuration principles for receivers

Receiver	GPS or RGPS	GPS or Glonass
M12M	GPS	GPS
ResolutionT	GPS	GPS
K161	GPS	GPS, Glonass, or GPS+Glonass
RGPS	RGPS	GPS

- In the **GPS Antenna Delay** field box, set the length of feeder.
  For the GPS feeder delivered by Huawei, delay = length of feeder (m) * (3.8 ns/m).
- In the **Antenna Power Supply Switch** field box, set the switch whether the DGPS board supplies power to the antenna.
  Usually, the antenna power supply switch must be on so that the antenna can work properly.
  On an antenna-shared site or in the case of changing the antenna or feeder, the antenna power supply switch can be off or on according to the actual application scenario.
- In the **Upper Alarm** field box, set the upper limit for the current of antenna.
- In the **Lower Alarm** field box, set the lower limit for the current of antenna.

Antenna Type	Default Limit		Value Range	
	Upper Limit	Lower Limit	Upper Limit	Lower Limit
GPS antenna	10 mA	100 mA	0–15 mA	45–155 mA
RGPS antenna	10 mA	150 mA	0–15 mA	125–175 mA

Step 5 After the configuration is complete, click **OK** in Step 3Figure 1.2 and return to the **Site Device Attribute** window as shown in Step 3Figure 1.1. Click **OK** as shown in Step 3Figure 1.1. Configuring the DGPS board is complete.

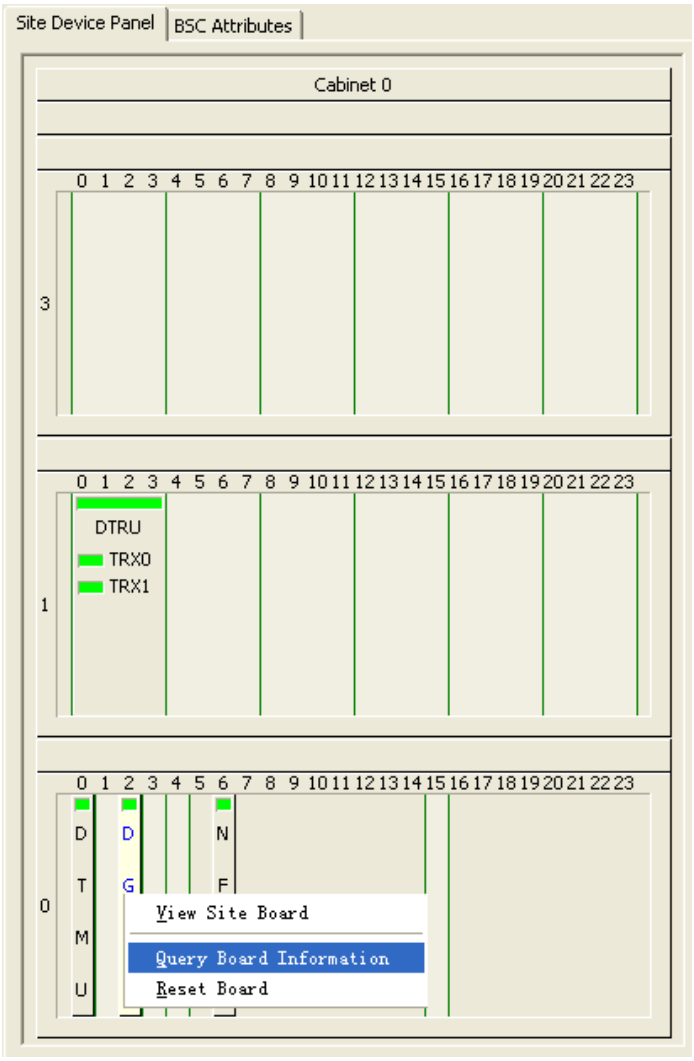
----End

Querying Information About the DGPS Board

Query the information about a DGPS board as follows:

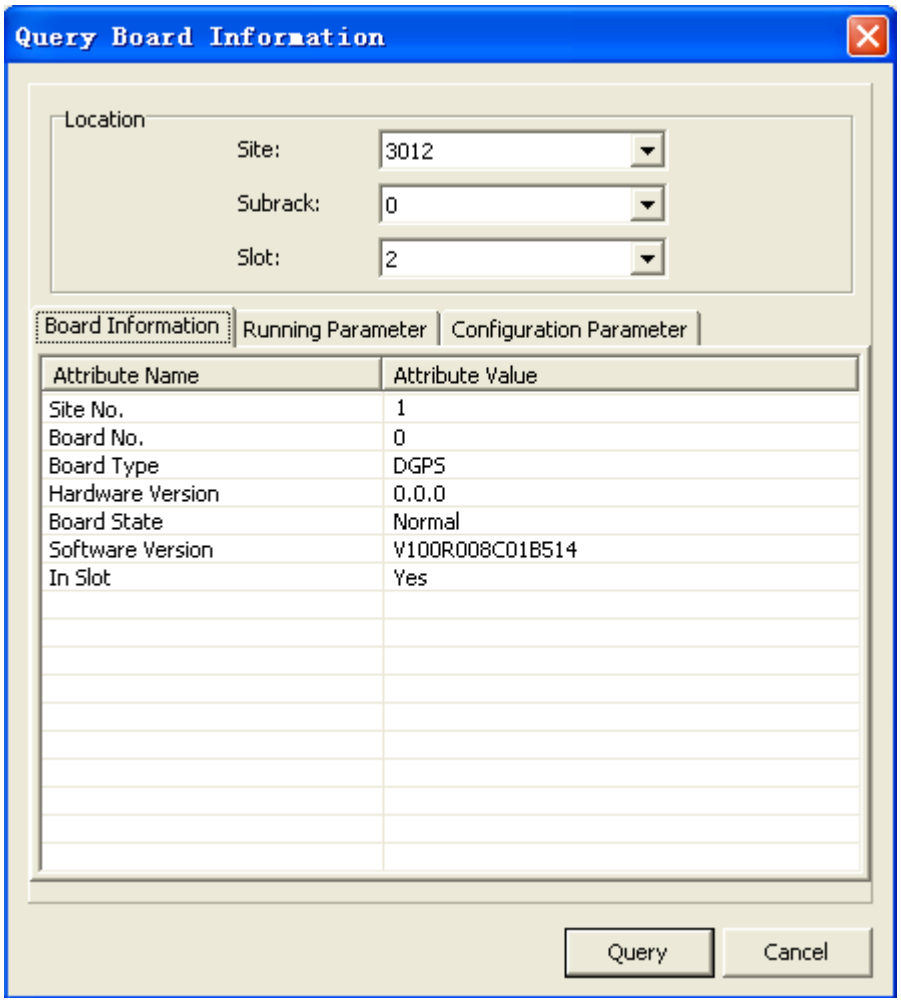
Step 1 Log in to the BSC6000 LMT as the super user. Right-click the DGPS to be queried and select **Query Board Information** from the shortcut menu, as shown in Figure 1.1.

Figure 1.1 Querying board information



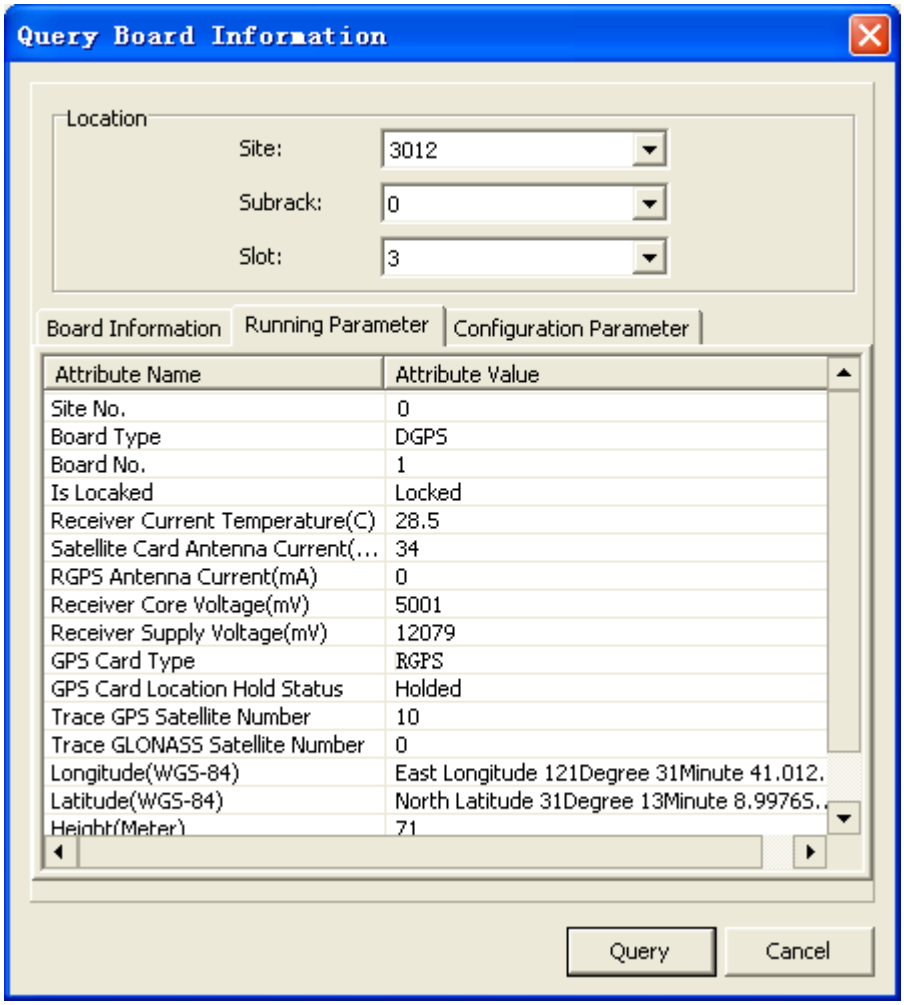
Step 2 In the **Query Board Information** window, click the **Board Information** tab page, you can query the information about the DGPS board, such as software version, hardware version, and in-slot status, as shown in Figure 1.1.

Figure 1.1 Result of queried information



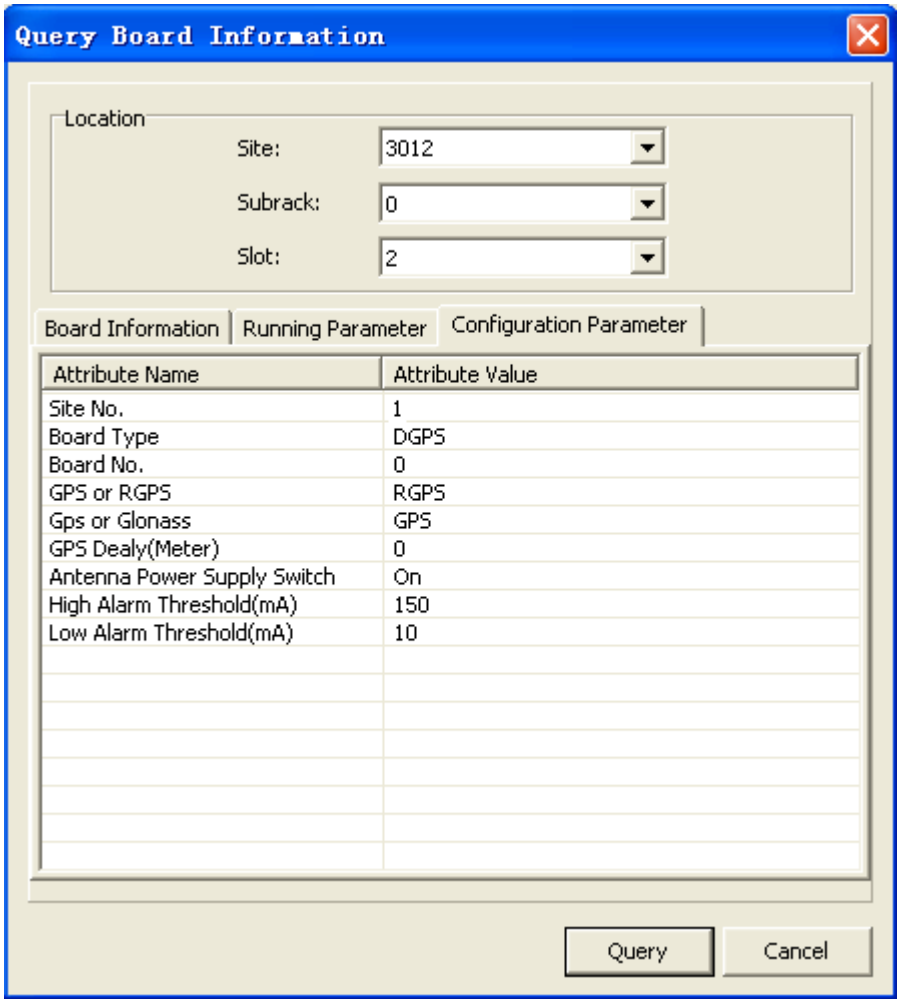
In the **Query Board Information** window, click the **Running Parameter** tab page, you can query the running parameters, as shown in Figure 1.2.

Figure 1.2 Result of Queried running parameters



In the **Query Board Information** window, click the **Configuration Parameter** tab page, you can query the configuration parameters, as shown in Figure 1.3.

Figure 1.3 Result of Queried configuration parameters



----End

Setting Clock Modes

To synchronize the whole network, modify the clock mode of the DTMU board to **Track GPS Clock**.

Set the clock mode in the following two ways:

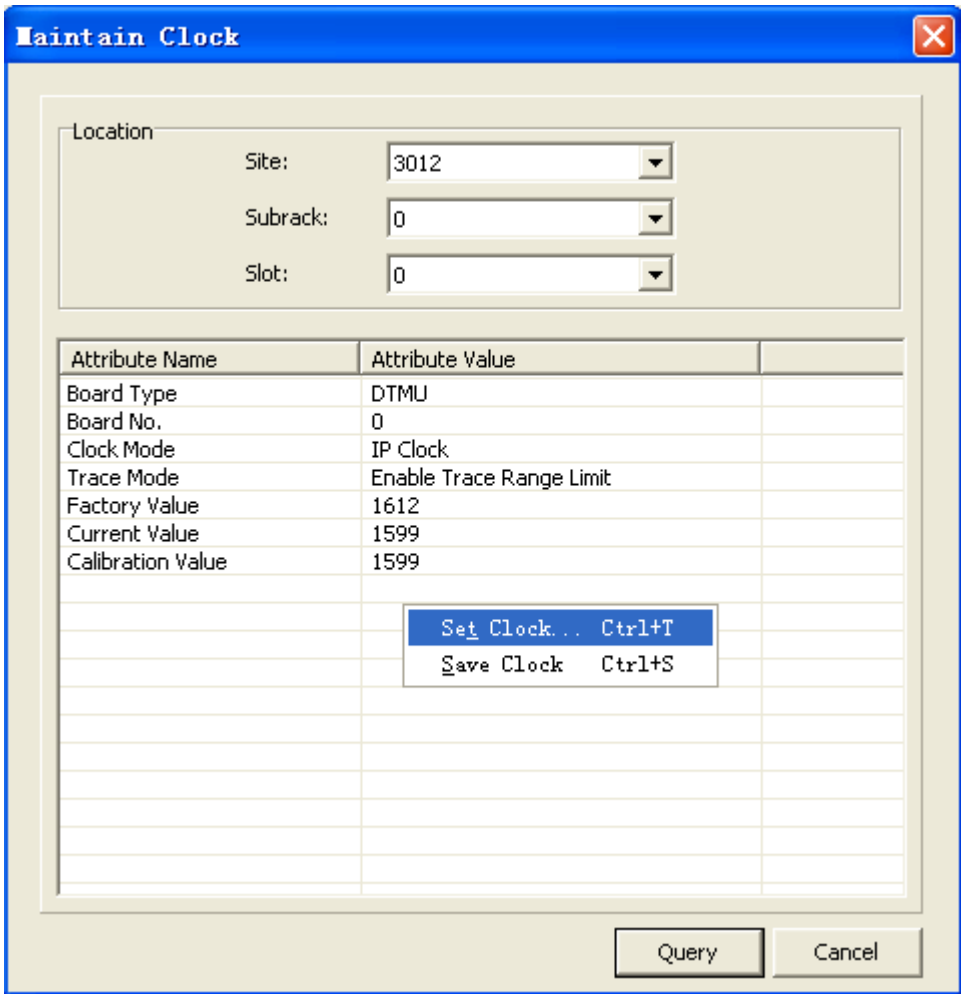
Method 1 proceeds as follows:

Step 1 Right-click the DTMU board and select **Maintain Clock** in the shortcut menu, as shown in Figure 1.1.

Figure 1.1 Maintaining clock

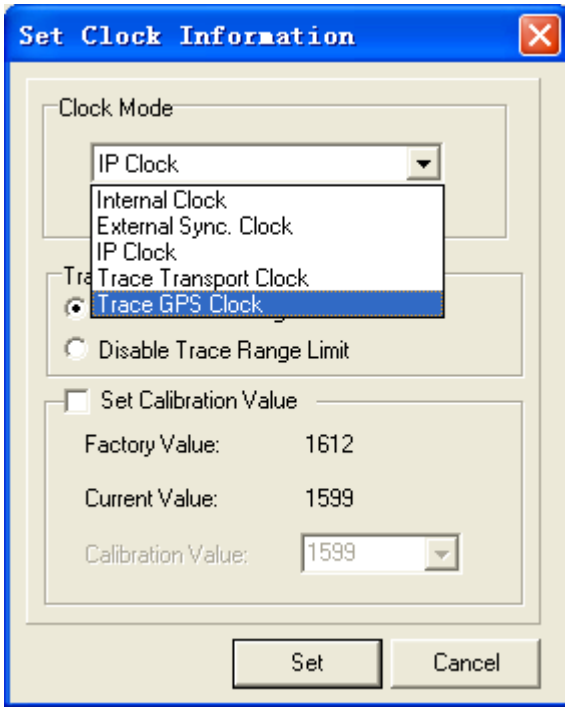
Step 2 In the **Maintain Clock** window, right-click in the blank area and select **Set Clock** in the shortcut menu, as shown in Figure 1.1.

Figure 1.1 Setting clock



Step 3 In the **Set Clock Information** dialog box, set the clock mode to **Track GPS Clock**, as shown in Figure 1.1. Click the **Set**. Setting the clock mode is complete.

Figure 1.1 Setting clock information

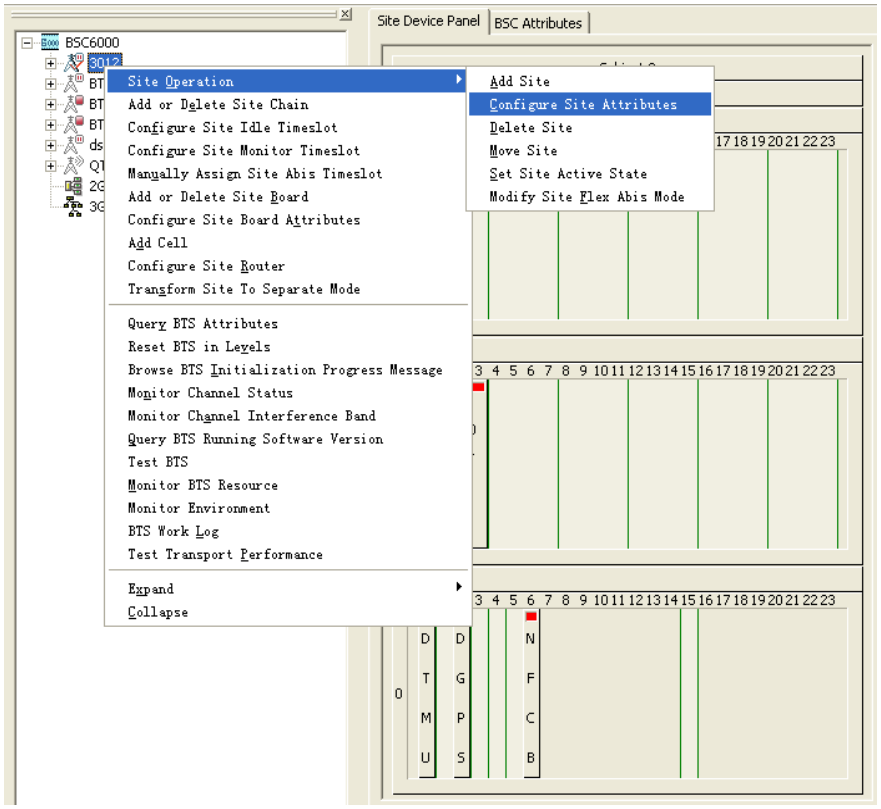


----End

Method 2 proceeds as follows:

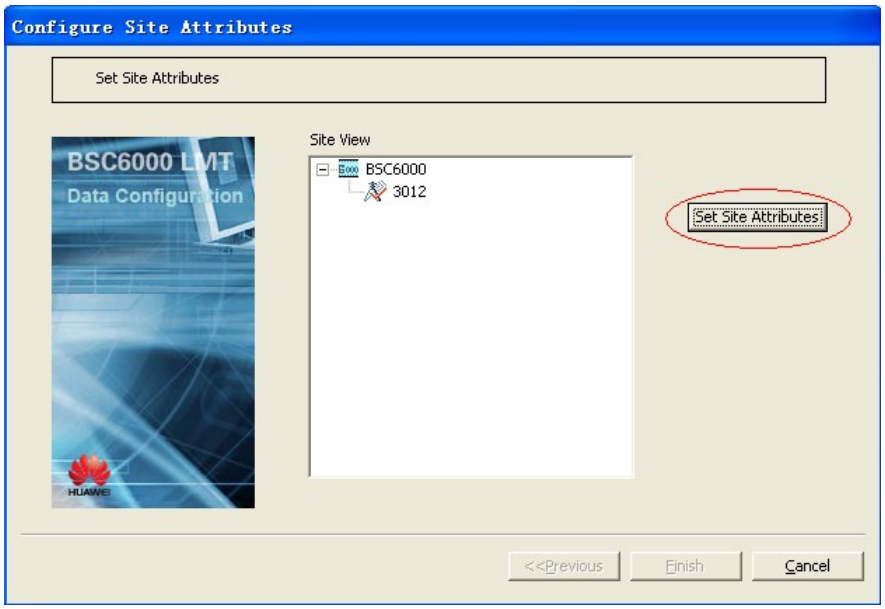
Step 4 Log in to the BSC6000 LMT. Select the site on which the clock mode is to be set, such as the site 3012 in Figure 1.1. Right-click on 3012, and select **Site Operations > Configure Site Attributes** from the shortcut menu.

Figure 1.1 Configuring the site attributes



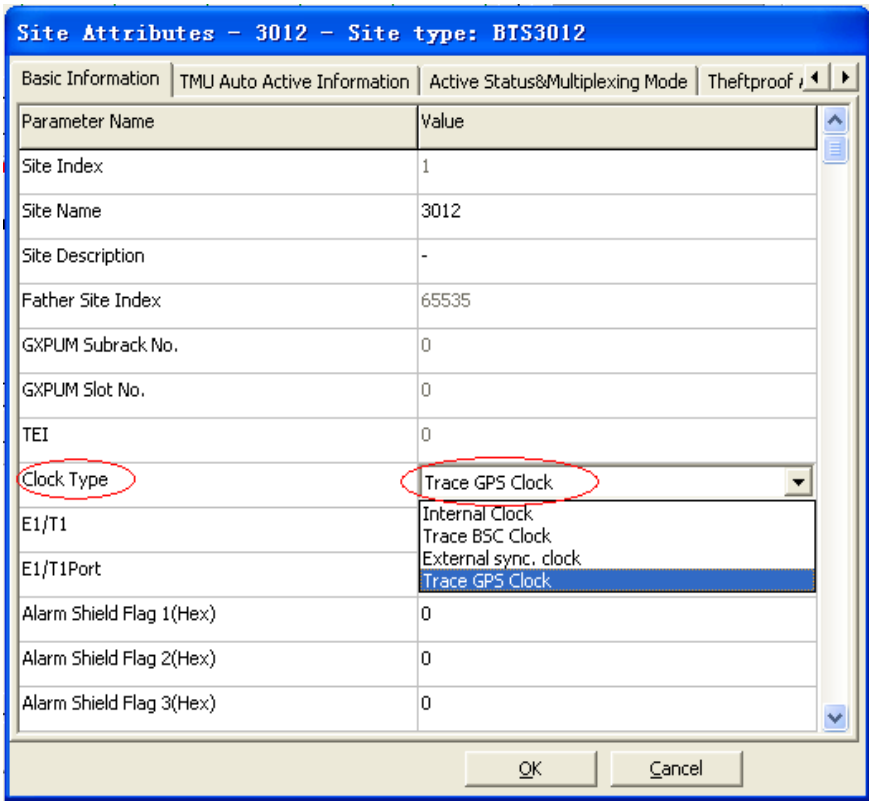
Step 5 Click **Set Site Attributes** in the **Configure Side Attributes** window, as shown in Figure 1.1.

Figure 1.1 Configure Site Attributes dialog box



Step 6 In the **Site Attributes** window, set the **Clock Type** to **Track GPS Clock**, as shown in Figure 1.1. Click **OK**, as shown in Figure 1.1. Return to the **Configure Site Attributes** window and click the **Finish**, as shown in Step 5Figure 1.1.

Figure 1.1 Site Attributes dialog box



3 Software Installation and Operation Guide in Deployment

3.1 Loading DGPS Software

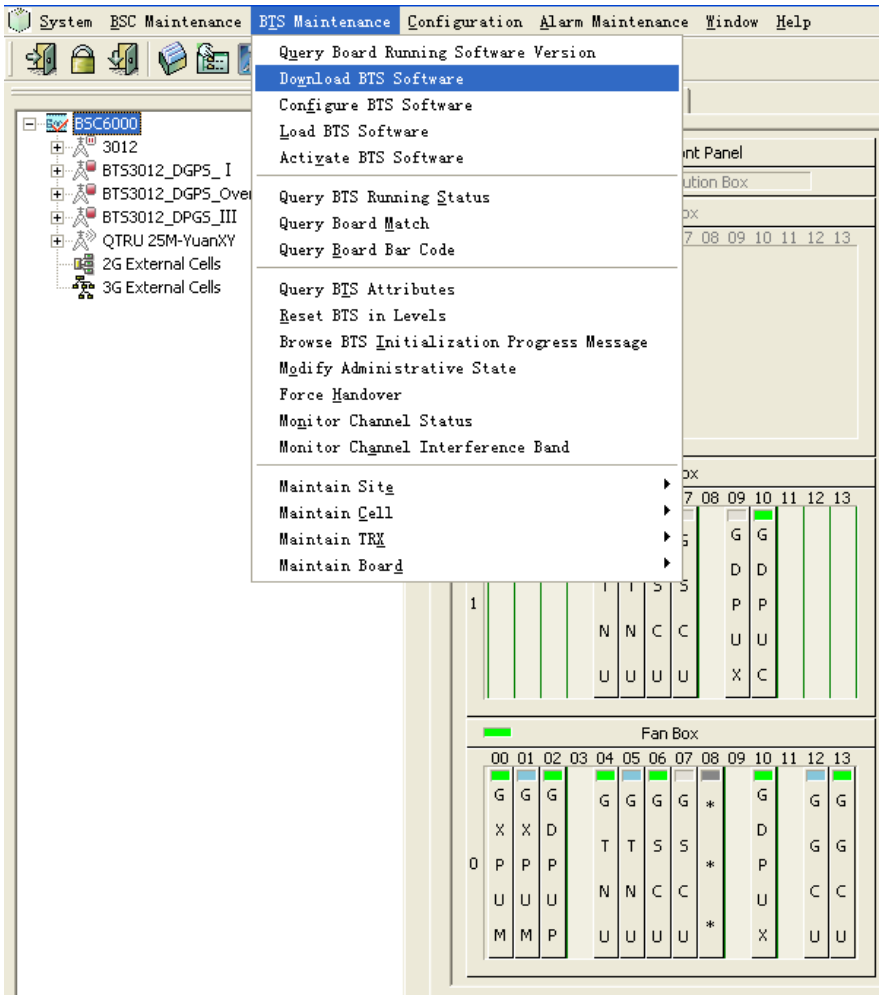
3.1.1 Downloading DGPS Software

Dowloading the DGPS software as follows:

Step 7 Before downloading DGPS software, copy DGPS software in the directory LMT installation directory\BSC6000\.

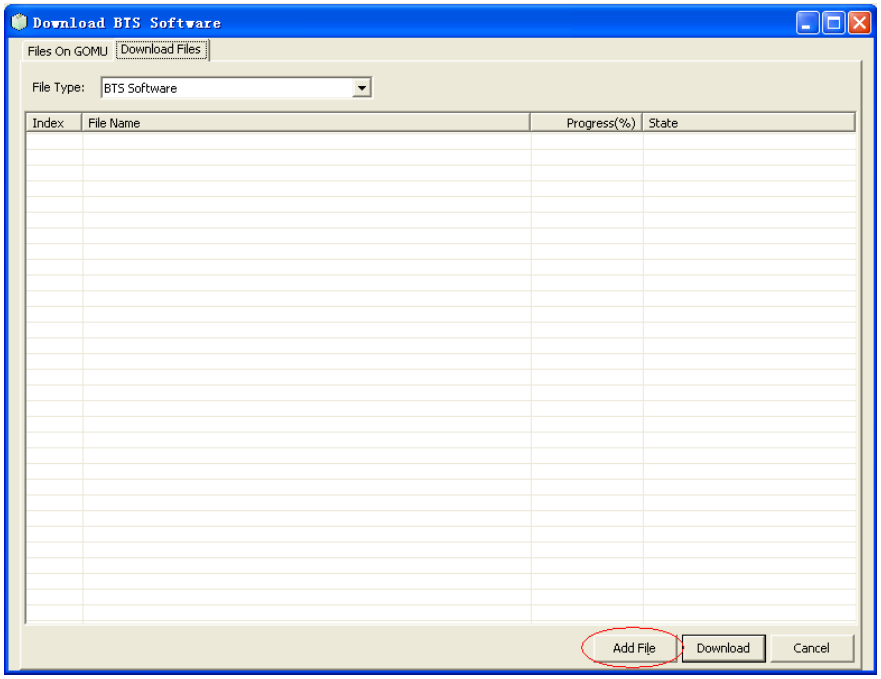
Step 8 Log in to the BSC6000 LMT and select BTS **Maintenance** > **Download BTS software**, as shown in Figure 1.1.

Figure 1.1 Downloading BTS software



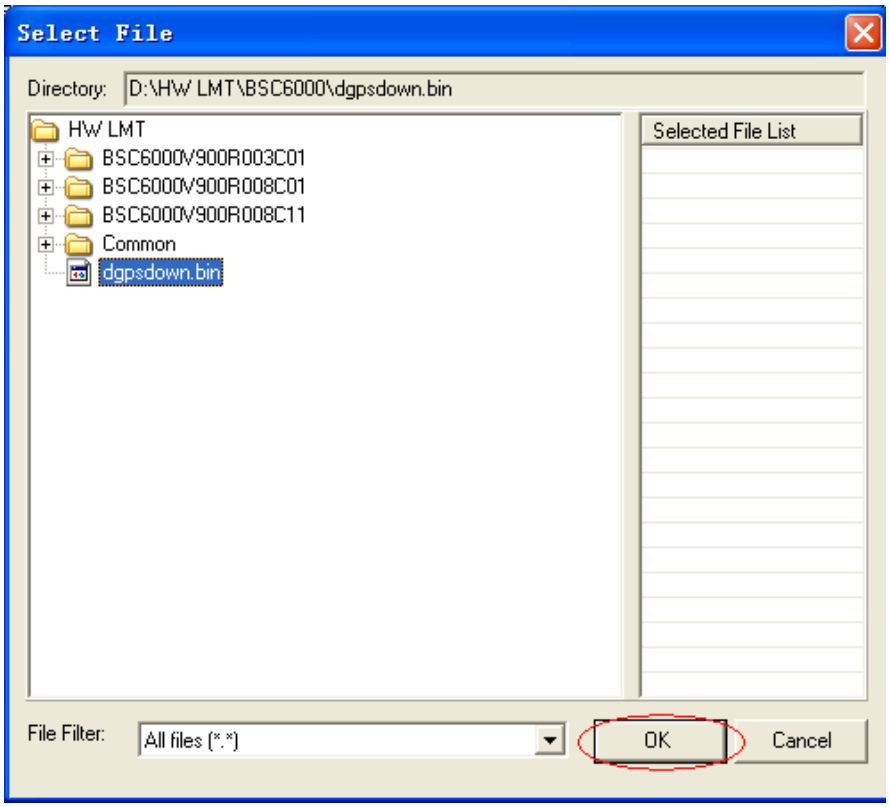
Step 9 In the **Download BTS Software** window, click the **Download Files** tab page and click the **Add File**, as shown in Figure 1.1.

Figure 1.1 Adding files



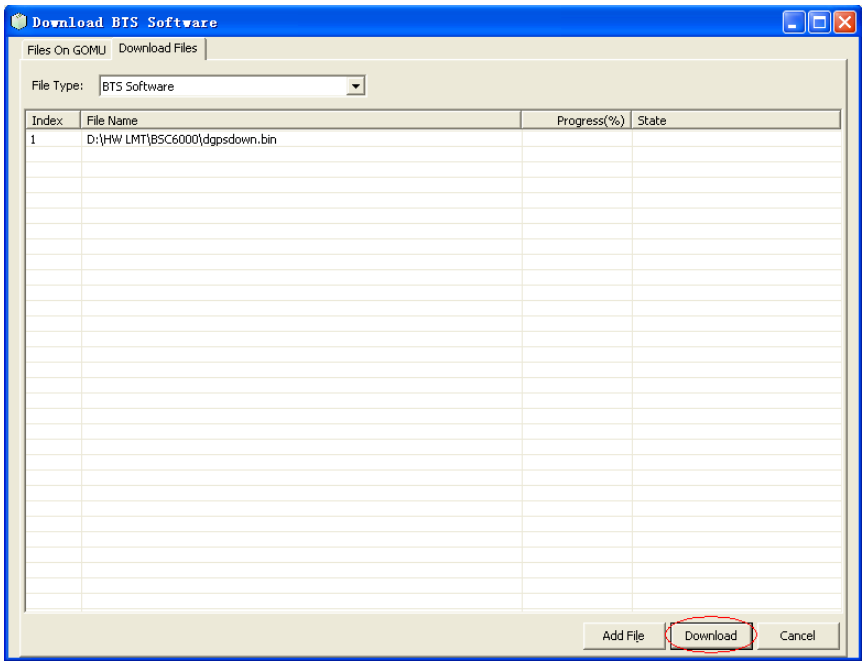
Step 10 In the **Select File** window, select the DGPS software and click **OK**, as shown in Figure 1.1.

Figure 1.1 Selecting files



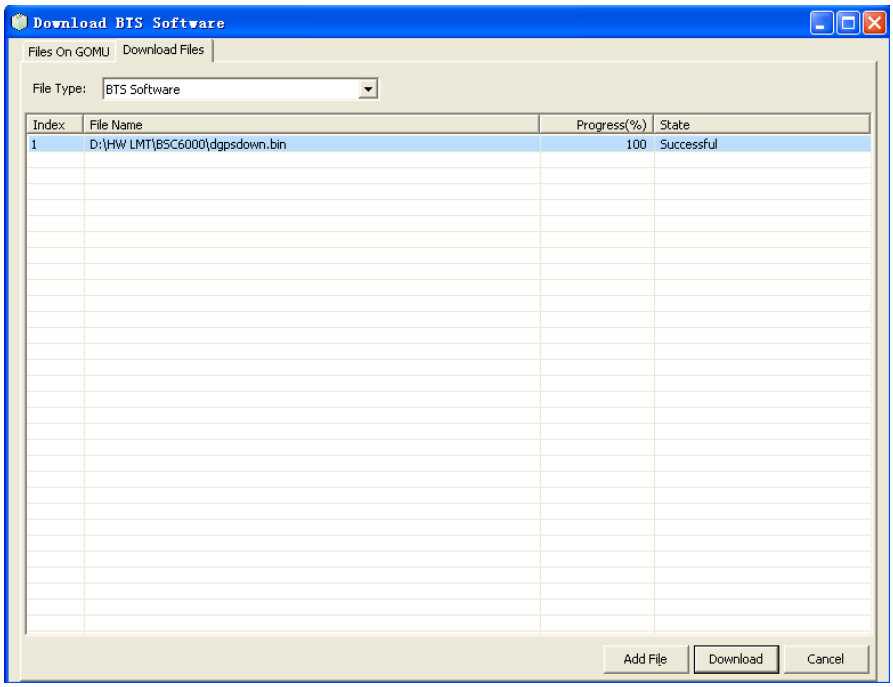
Step 11 In the Download BTS Software window, you can see the added file, as shown in Figure 1.1.

Figure 1.1 List of the downloaded file



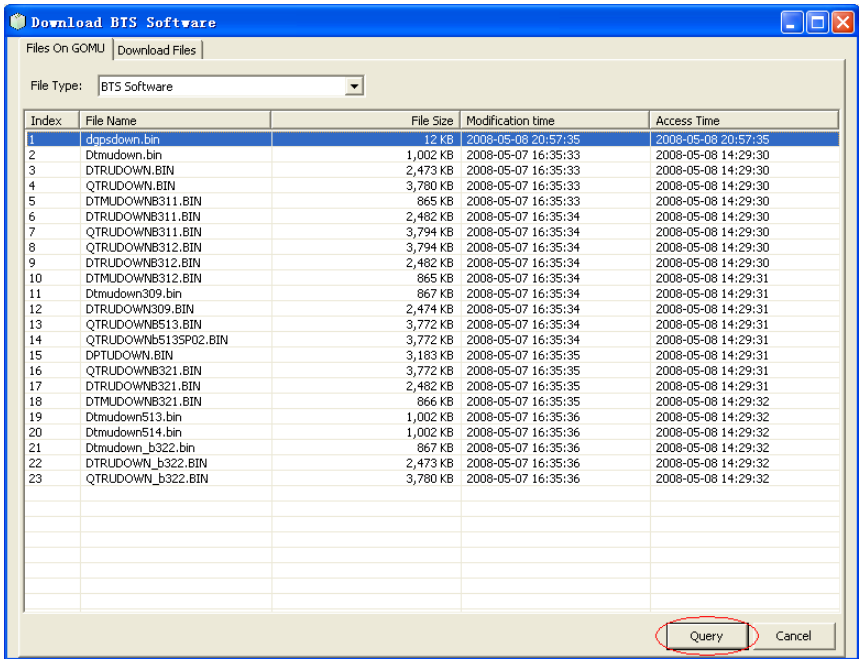
Step 12 Click **Download** to download the DGPS software to the GOMU board, as shown in Figure 1.1.

Figure 1.1 Status of downloading the file



Step 13 After downloading, click the **Files on GOMU** tag page, as shown in Figure 1.1. Click **Query** to query all the files downloaded on the GOMU board.

Figure 1.1 Querying files on the GOMU board



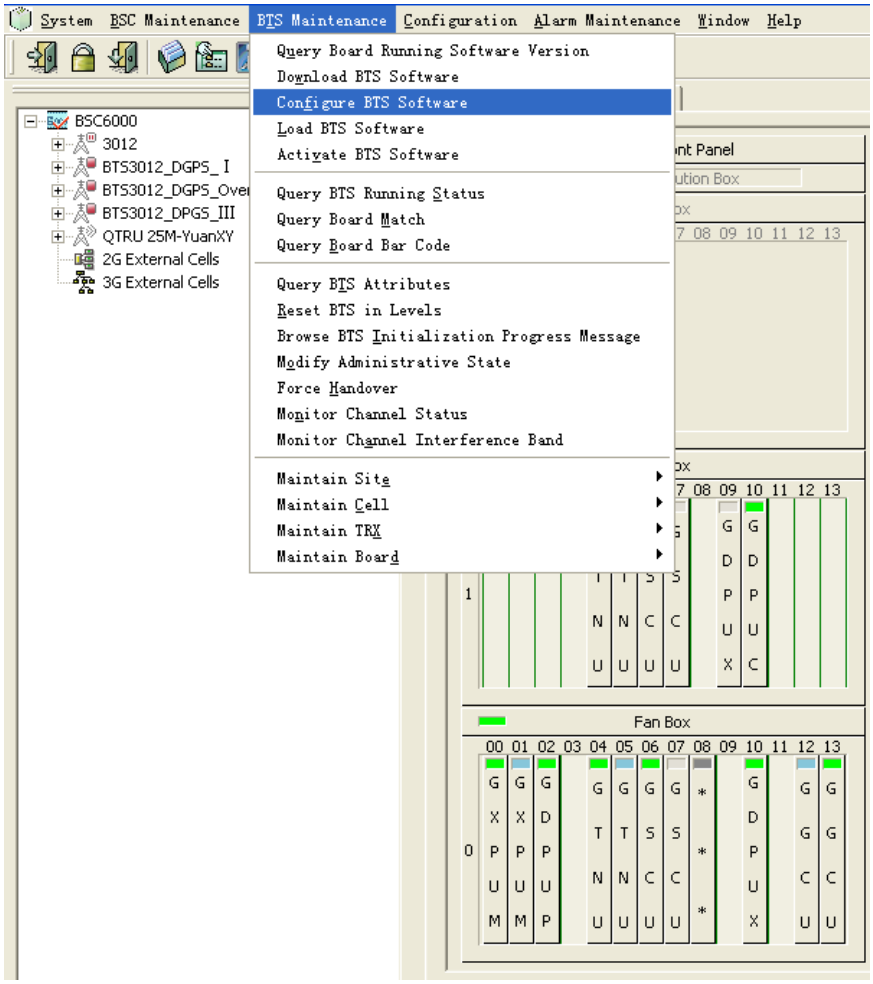
----End

3.1.2 Configure the Software

Configure the BTS software as follows:

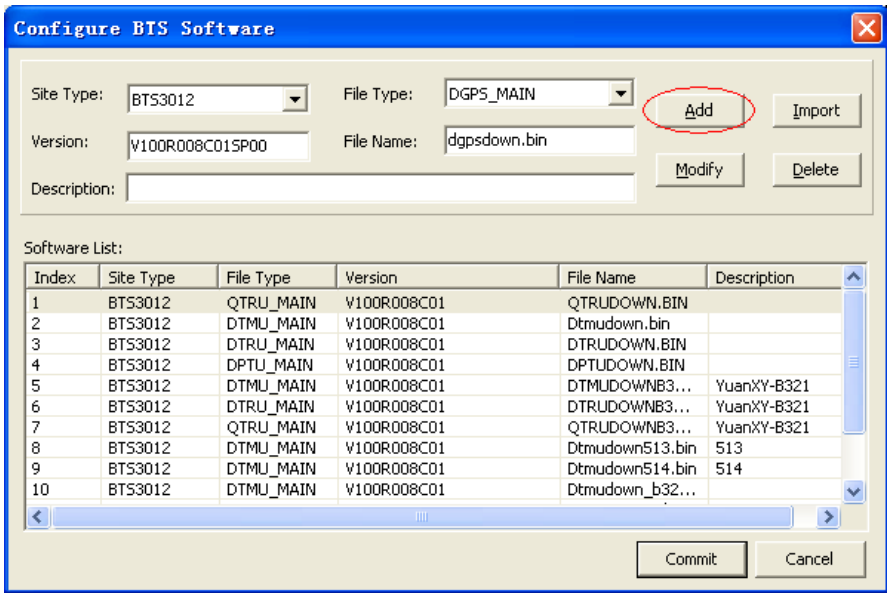
Step 14 Log in to the BSC6000 LMT and select **BTS Maintenance > Configure BTS software**, as shown in Figure 1.1.

Figure 1.1 Configuring BTS software



Step 15 In the Configure BTS Software dialog box, input the information according to the local scenario, as shown in Step 15. For the DGPS software, select **DGPS_MAIN** from the **File Type** drop-down list. After input, click **Add**. If the adding is successful, the added software is displayed in the **Software List** field box, as shown in Figure 1.1.

Figure 1.1 Configuring BTS software-adding



Step 16 Click **Commit**, as shown in Figure 1.1. An **Information** window is displayed, as shown in Figure 1.2, and configuring the BTS software is complete.

Figure 1.1 Configuring BTS software-committing

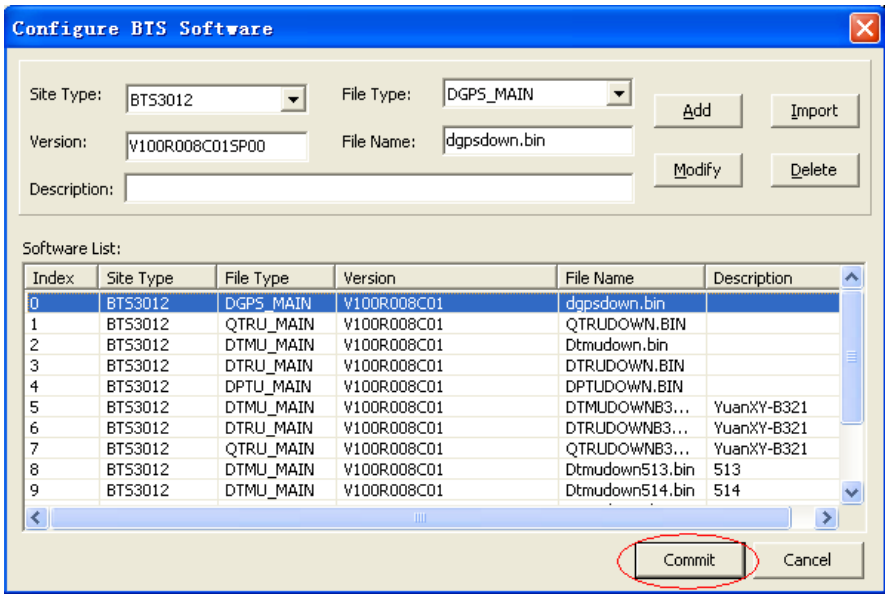
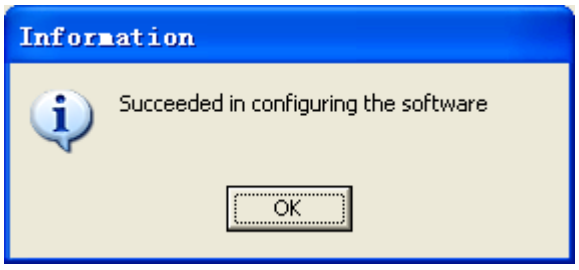


Figure 1.2 Information dialog box



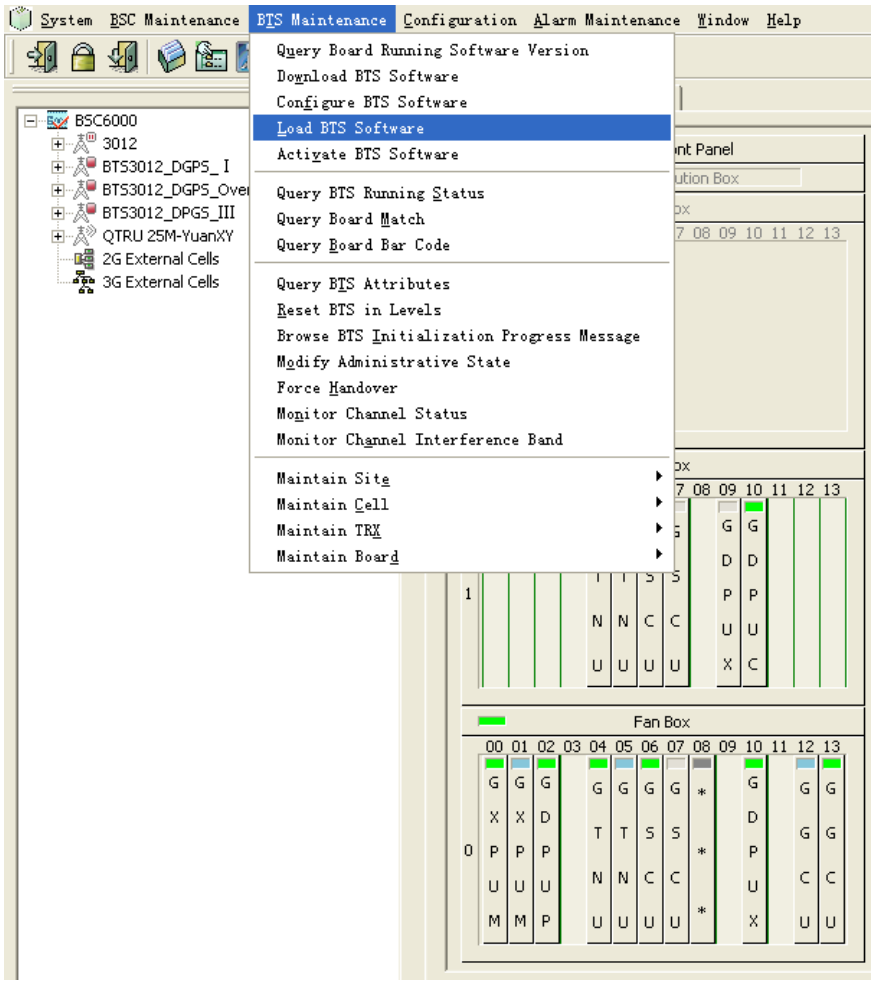
----End

3.1.3 Doading Software

Load the BTS software as follows:

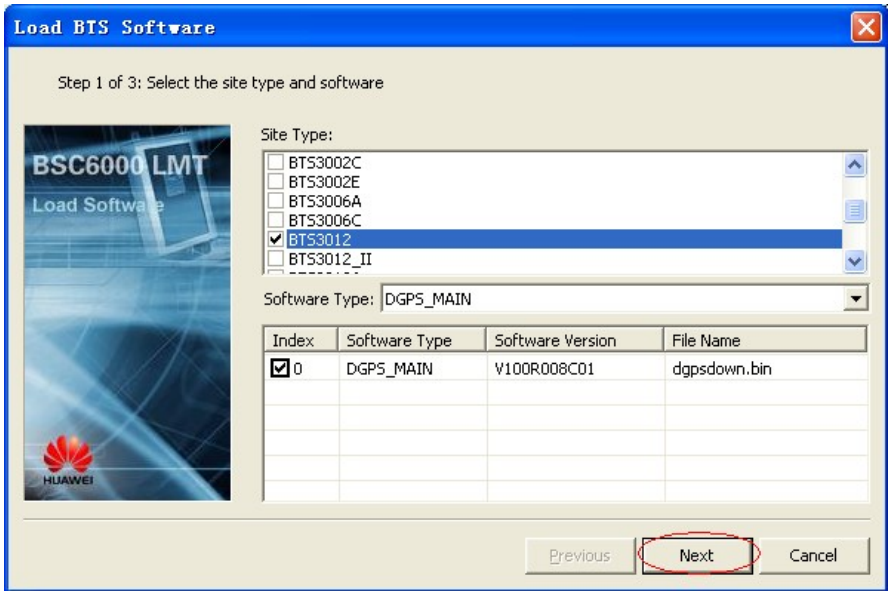
Step 17 Log in to the BSC6000 LMT and select **BTS Maintenance > Load BTS software**, as shown in Figure 1.1.

Figure 1.1 Loading BTS software



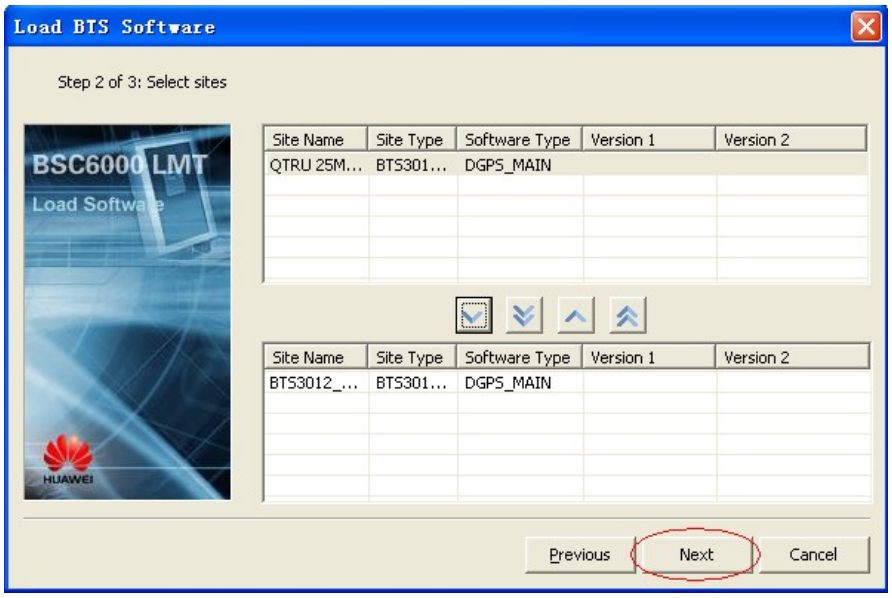
Step 18 Select the proper site type from the **Site Type** area and proper software type from the **Software Type** drop-down list, the available software for loading is displayed in the list. Select the software to be loaded, and click **Next**, as shown in Figure 1.1.

Figure 1.1 Loading BTS software-step 2



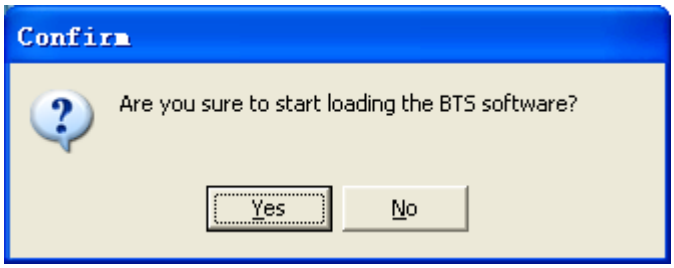
Select the site with its software to be loaded in the list, as shown in Figure 1.2. For selection, select the site in the upper list and click the button. For deselection, select the site in the lower list and click the button. For selecting all, click the button. For deselecting all, click the button. When you double-click a site in the upper list, you select the site. When you double-click a site in the lower list, you deselect the site.

Figure 1.2 Loading BTS software-step 2



Step 19 After selection, click **Next**. A **Confirm** dialog box is displayed, as shown in Figure 1.1.

Figure 1.1 A Confirm dialog box



Step 20 Click **Yes**. A **Load BTS Software** window is displayed, as shown in Figure 1.1. Loading the BTS software is started. When the loading is complete, click **Finish** to exit.

Figure 1.1 Loading BTS software-step 3

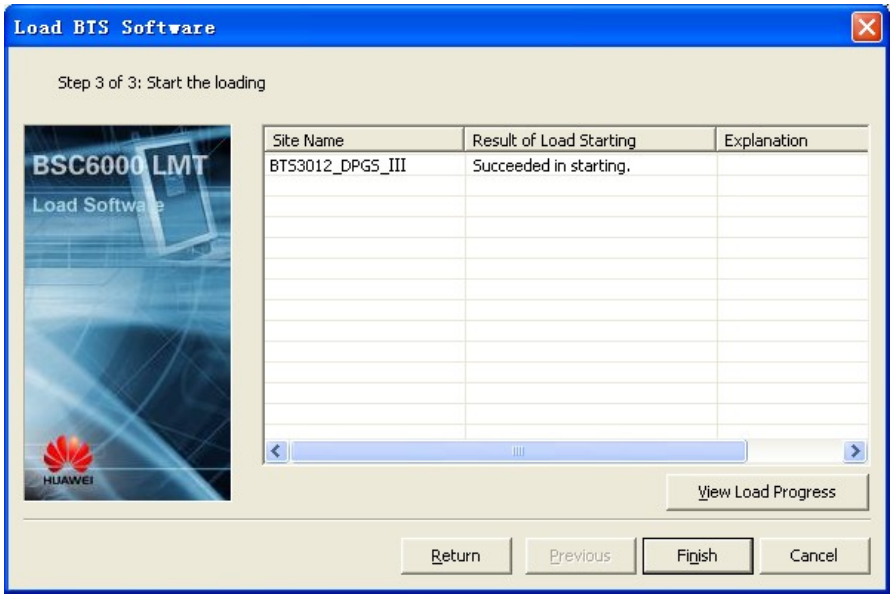
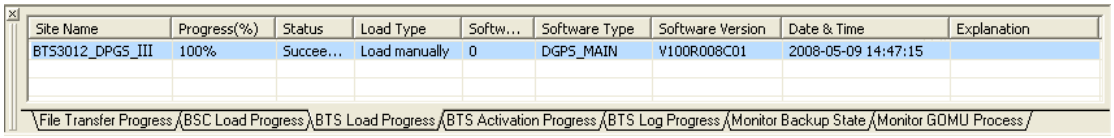


Figure 1.2 Progress of loading



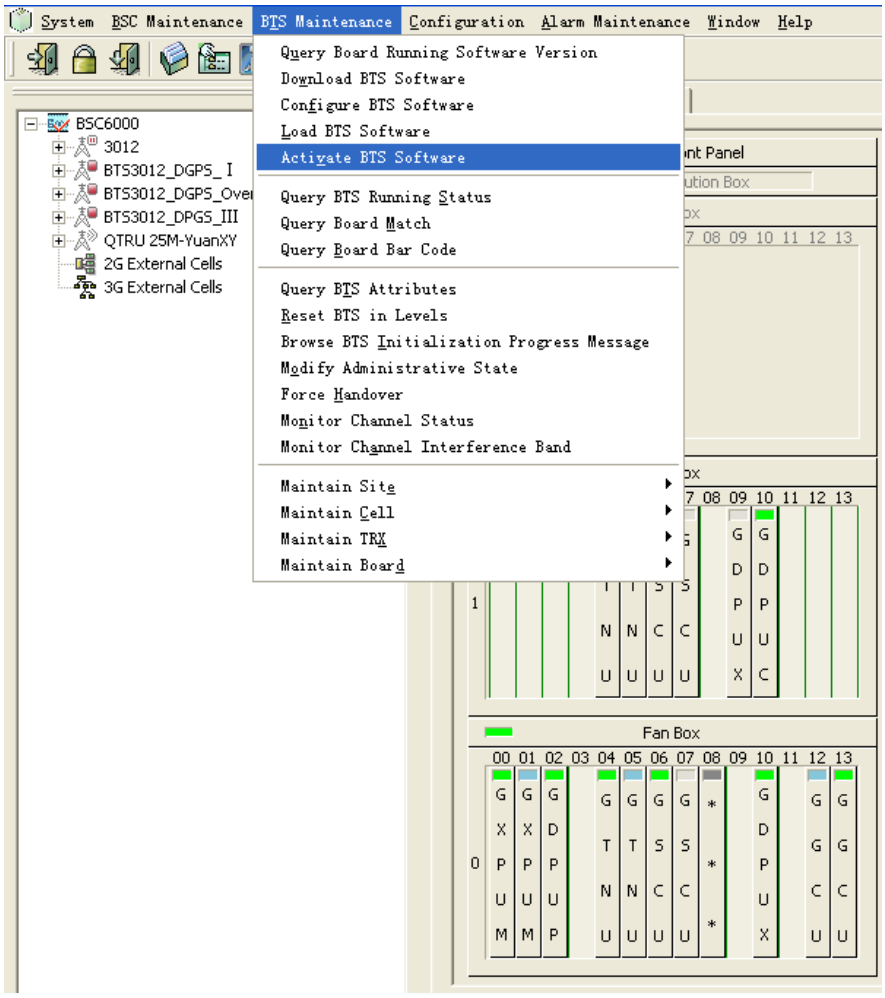
----End

3.2 Activating DGPS Software

Activate the DGPS software as follows:

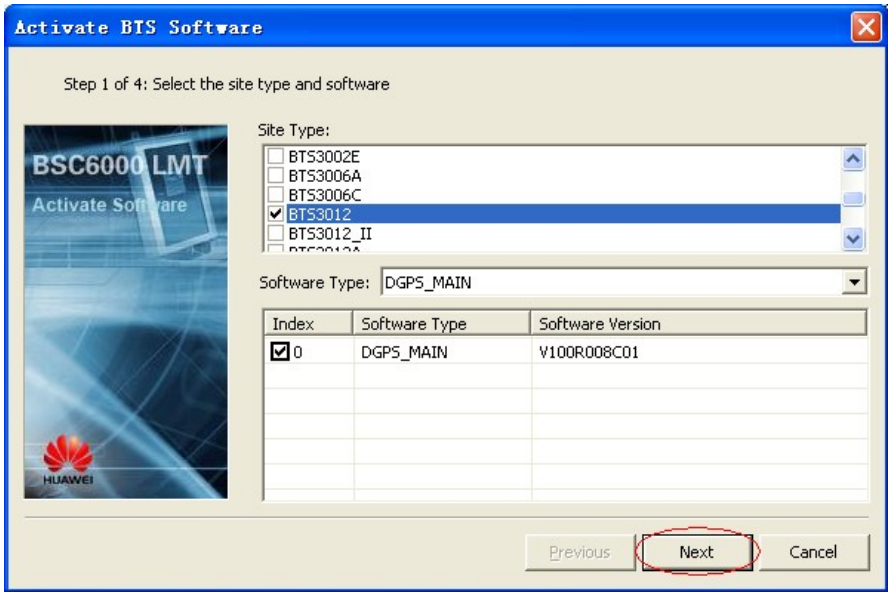
Step 21 Log in to the BSC6000 LMT and select **BTS Maintenance > Activate BTS Software**, as shown in Figure 1.1.

Figure 1.1 Activating BTS software



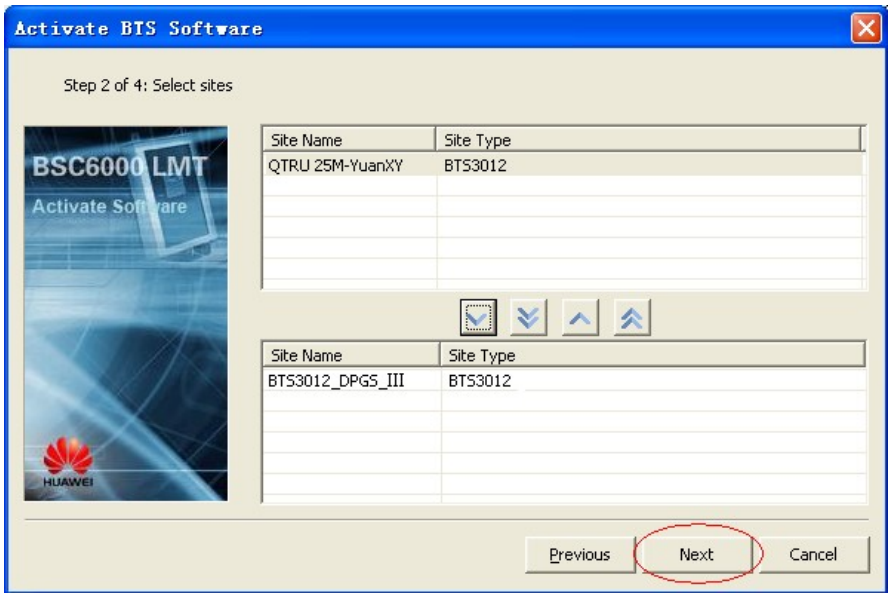
Step 22 Select the proper site type from the **Site Type** area and proper software type from the **Software Type** drop-down list, the available software for loading is displayed in the list. Select the software to be activated, and click **Next**, as shown in Figure 1.1.

Figure 1.1 Activating BTS software-step 1



Select the site with its software to be activated in the list, as shown in Figure 1.2. For selection, select the site in the upper list and click the button. For deselection, select the site in the lower list and click the button. For selecting all, click the button. For deselecting all, click the button. When you double-click a site in the upper list, you select the site. When you double-click a site in the lower list, you deselect the site. After selection, click **Next**.

Figure 1.2 Activating BTS software-step 2

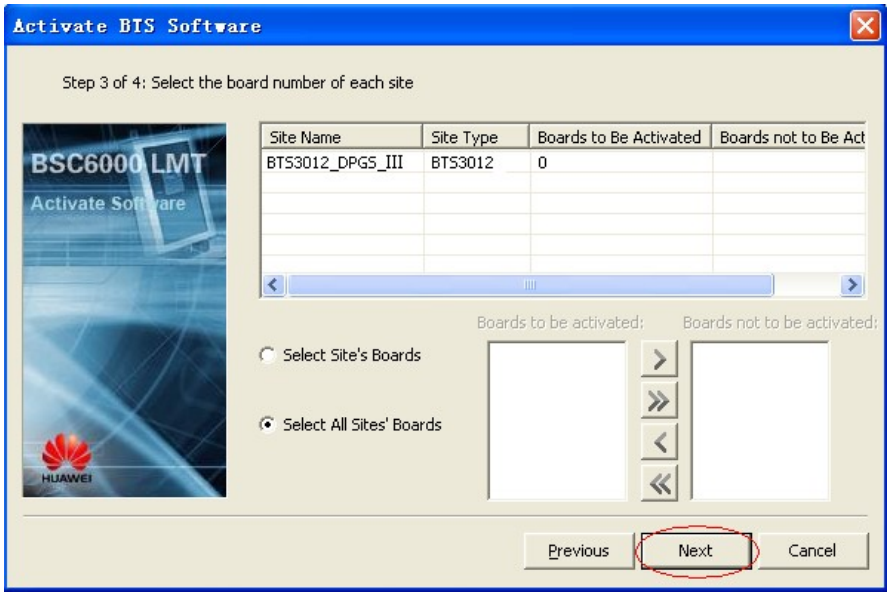


Step 23 Select the board to be activated for the selected site.

Click **Select All Sites' Boards** to activate all the boards in the site list, as shown in Figure 1.1.

Click **Select BTS Software** to manually select boards in **Boards to be activated** and **Boards not to be activated** list. If you select a site in the site list, the boards to be activated on the site are displayed in the **Boards to be activated** list. Click  to select the boards not to be activated. Click  to move all the boards in the **Boards to be activated** list to the **Boards not to be activated** list. On the contrary, you can click  or  to move the board in the **Boards not to be activated** list to the **Boards to be activated** list.

Figure 1.1 Activating BTS software-step 3



Step 24 After selection, click **Next**. A **Confirm** dialog box is displayed, as shown in Figure 1.1. Click **Yes** to activate the selected software.

Figure 1.1 A Confirm dialog box

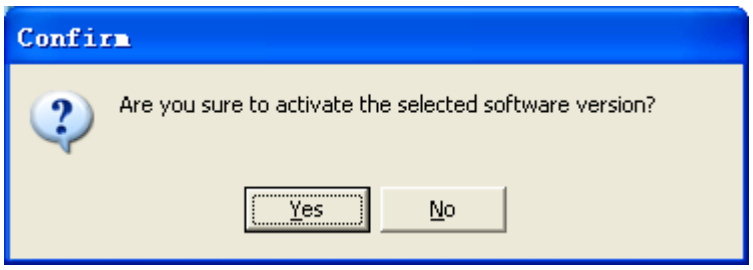


Figure 1.2 Activating BTS software-step 4

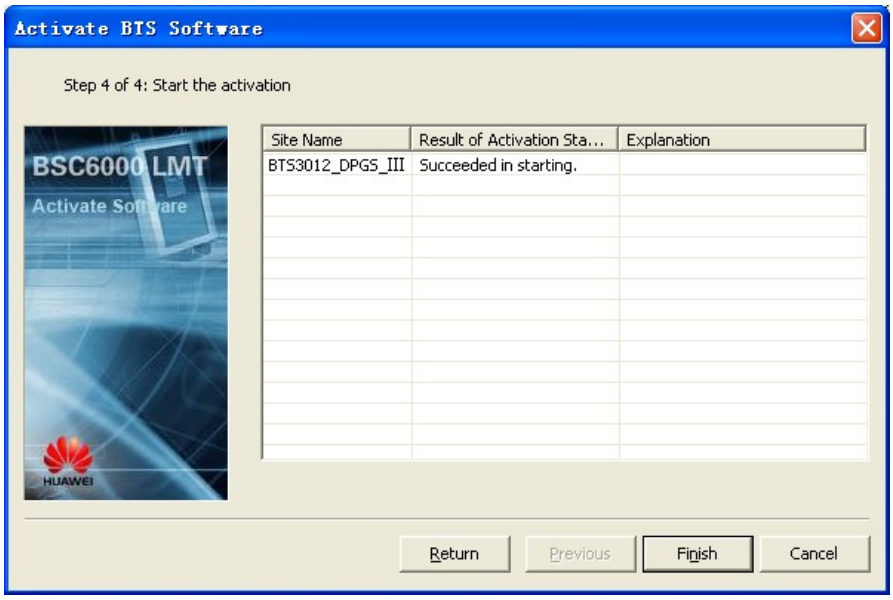
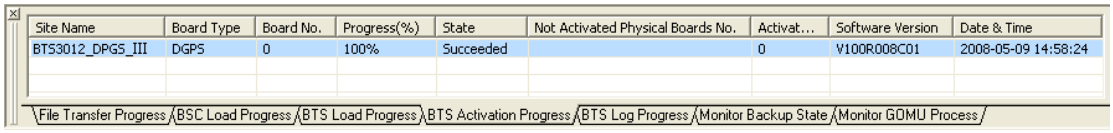


Figure 1.3 Progress of activation



----End

3.3 Verifying Software Upgrade

3.3.1 Verifying the Version After Software Upgrade

Through MMI or on the site maintenance terminal, verify whether the following software version after upgrade is correct.

- DTMU version
- DGPS version
- Version of other boards to be upgraded if there is any

For details about verifying the DGPS version, refer to IStep 5.

3.3.2 Querying the BTS Running Status

After upgrade at the BTS, check the LEDs whether they work properly.

Check the MMI or the status of boards on the Site Maintenance Terminal whether alarms are reported.

4 Troubleshooting

4.1 Basic Operations for Locating Board Problems

For details about locating board problems, refer to *Huawei BTS3012 Deployment Guide*. For the meaning and processing of alarms on boards, refer to documents related to alarms on the DGPS board.

Table 3.1 lists the description of alarms related to the DGPS board.

Table 3.1 Description of the alarms on the DGPS board

Alarm Name	Alarm Severity	Alarm Description
GPS Board communication alarm	Major	The GPS board does not well communicate with the main controlling module.
Gps Receiver Signal lost alarm	Warning	The GPS board cannot receive GPS satellite signals, so the alarm is reported.
Gps Receiver Communication alarm	Major	When the GPS receiver does not well communicate with the main controlling module, the alarm is reported.
Gps Board Work Mode Config Error alarm	Minor	When the configured work mode for GPS receiver is inconsistent with the type of GPS receiver, the alarm is reported.
GPS Board Hardware Failure alarm	Major	GPS board hardware failure alarm

GPS Receiver Antenna Failure alarm	Major	When the current of GPS antenna is improper, the alarm is reported.

4.2 Troubleshooting

4.2.1 GPS Board Communication Alarm

Causes

The GPS board is not installed, the main controlling module fails to communicate with the GPS board, or the main controlling module fails, so the alarm is reported.

Solution

1. Check whether the GPS board is correctly installed. Ensure that the GPS board is securely connected to the backplane.
2. By changing the slot, check whether the connection between the main controlling module and the GPS board works properly. Ensure that no hardware fault is present between them.
3. Check whether the main controlling module works properly. If the boards connected to it work properly, it can be considered in good condition. If the condition permits, replace the main controlling module for rectifying the fault.

4.2.2 GPS Receiver Signal Lost Alarm

Causes

When the GPS receiver signals are temporarily lost due to external blocking or bad weather conditions or the GPS receiver works improperly, the alarm is reported.

Solution

1. Check whether GPS receiver antenna failure alarms or other alarms are reported. If there are, clear these alarms. This GPS receiver signals lost alarm may be cleared after other alarms are cleared.
2. If other alarms are not reported, the cause to GPS receiver signal lost alarm must be external blocking or bad weather conditions. After the external blocking is cleared and when it is fine outside, check whether the GPS receiver signal lost alarm is cleared.

4.2.3 GPS Receiver Communication Alarm

Causes

When the GPS or RGPS configuration does not match the physical configuration, the GPS receiver encounters a hardware failure, or the main controlling module fails, the alarm is reported.

Solution

1. Check whether the GPS or RGPS configuration matches the physical configuration. For example, when a GPS receiver is used, the GPS channel and its power supply switch must be turned on. However, if the RGPS channel is selected in parameter setting, the GPS receiver communication alarm is reported.
2. To rectify the GPS receiver hardware failure, replace the DGPS board and check whether the alarm is cleared.
3. Check whether the main controlling module works properly. If the boards connected to it work properly, it can be considered in good condition. If the condition permits, replace the main controlling module for rectifying the fault.

4.2.4 GPS Board Work Mode Config Error Alarm

Causes

When the configured work mode for GPS receiver is inconsistent with the type of GPS receiver, the alarm is reported.

Solution

1. Check whether the configured work mode (GPS, Glonass, or GPS+Glonass) is consistent with the physical type of GPS receiver.
2. Set parameters according to the physical type of GPS receiver, and then check whether the GPS receiver can work properly.
3. Replace the GPS board. Rectify faulty boards.

4.2.5 GPS Board Hardware Failure Alarm

Causes

When the power supply is improper or the processor of GPS board works improperly, the alarm is reported.

Solution

1. If the on-site condition permits, check whether the 5 V/12 V voltage at the GPS antenna port and RGPS power supply port is proper.
2. If no tester is available on site, reset the board and check whether the alarm is cleared.
3. If the alarm is still present, replace the GPS board.

4.2.6 GPS Receiver Antenna Failure Alarm

Causes

The current of GPS antenna or RGPS antenna is improper due to the following causes:

- The GPS antenna or the lightning arrester fails, or the RF cable encounters short circuit.
- The RGPS antenna cable fails or the power supply cable encounters short circuit.
- The threshold for antenna current is inconsistent with the threshold work current of GPS receiver.

Solution

1. Check the subroute number of the alarm. If the subroute number is 0, the current of GPS antenna is improper; rectify the alarm by following the steps 2, 4, and 5 below. If the subroute number is 1, the current of RGPS antenna is improper; rectify the alarm by following the steps 3 and 4 below.
2. When the current of GPS antenna is improper, disconnect the GPS extension cable from the GPS board. Use a multimeter to detect whether short circuit is present between the core conductor and grounding shield of GPS extension cable. If there is, rectify the short circuit. After this, reconnect the GPS extension cable to the GPS board, power on the GPS antenna, and check whether the alarm is cleared. If there is no short circuit, check whether the connector of antenna on the top of cabinet is securely connected to the GPS board. Reconnect them and check whether the alarm is cleared.
3. When the current of RGPS antenna is improper, disconnect the RGPS cable from the GPS board. Use a multimeter to detect whether short circuit is present between 12 V port and the GND port. If there is, rectify the short circuit. After this, reconnect the RGPS cable to the GPS board, power on the RGPS antenna, and check whether the alarm is cleared. If no short circuit is present, check whether the RGPS cables (including two power supply cables, two 1pps signal cables, and four TRX cables) are correctly connected. For details about cable connection, refer to Description of the Ports on the DGPS Board.
4. Check whether the threshold for antenna current is consistent with the threshold work current of GPS receiver. For example, the normal work current of GPS antenna (as described in the instruction guide to receiver) is 110 mA. Set the upper limit of current to above 110 mA, such as 120 mA. If it is set to 100 mA, the GPS receiver antenna failure alarm is reported.
5. On an antenna-shared scenario, if a GPS receiver antenna failure alarm is reported 10 minutes after the GPS boards of two BTSs are powered on, rectify the alarms as described in steps 2 and 4. If the alarm is cleared within 10 minutes, neglect the alarm.

5 Appendix

5.1 Description of LEDs on the DGPS Board

There are three LEDs on the panel of DGPS board, described in Table 1.1.

Table 1.1 LEDs on the DGPS board

LED	Color	Description	Status	Indication
RUN	Green	Operating indicator of the board	Flashing at 0.25 Hz	There is power supply and the board operates normally. However, the connection between the board and the CBUS3 is not established or the CBUS3 link is not normal.
			Flashing at 0.5 Hz	The board operates normally and the CBUS3 link is normal.
			Off	There is no power supply or the board is faulty.
ACT	Green	Indicator of the service running status	On	The DGPS board receives the configuration data issued by the DTMU.
			Off	The DGPS board does not receive the configuration data issued by the DTMU.
ALM	Red	Alarm indicator	On	An alarm associated with the board is generated, such as hardware alarm, short-circuit alarm, or communication alarm.
			Off	The board operates normally, and no alarm is reported.

5.2 Description of the Ports on the DGPS Board

There are four input/output ports on the panel of DGPS board, as shown in Figure 5.2.

Figure 5.2 Panel of the DGPS board

Table 2.1 lists the description of previous ports.

Table 2.1 Description of ports on the DGPS board

Board Silkscreen	Port Type	Description	Application Scenario
ANT	SMA	GPS/GLONASS antenna port, used to supply power to the GPS/GLONASS active antenna and receive GPS/GLONASS synchronized signals.	It is mainly applied in scenarios where a new antenna system is deployed.
1PPS	SMB	Test port, used to export TTL level 1PPS signals, used in tests.	Used in laboratory tests
TX+, Tx-, and so on	Wiring Terminal Block	RGPS antenna port, used to export +12 V power, receive 1PPS signals of RS422 differential level, and receive/send serial signals of RS422 differential level.	Used in scenarios where the competitors' equipment is replaced by Huawei equipment.

COM	RJ45	Differential data port, used to share GPS/GLONASS signals. This port exports 1PPS signal of RS422 differential level and receives/sends serial signals.	Used to provide satellite signals for other equipment

NOTE

When the competitors' BTSs are replaced by Huawei BTSs, the RGPS antenna port should be used. Its cabling should be made on site. The making depends on the type and length of cables on site. If the competitor's RGPS cable is short, extend it with Ethernet cable and connect it to the DGPS board. Figure 5.3 shows the panel of competitor’s RGPS board and its cable connection. The P6 (marked in red) is connected to the corresponding ports of the DGPS board, with the connection listed in Table 4.1.

Figure 5.3 Connection of competitor’s RGPS antenna

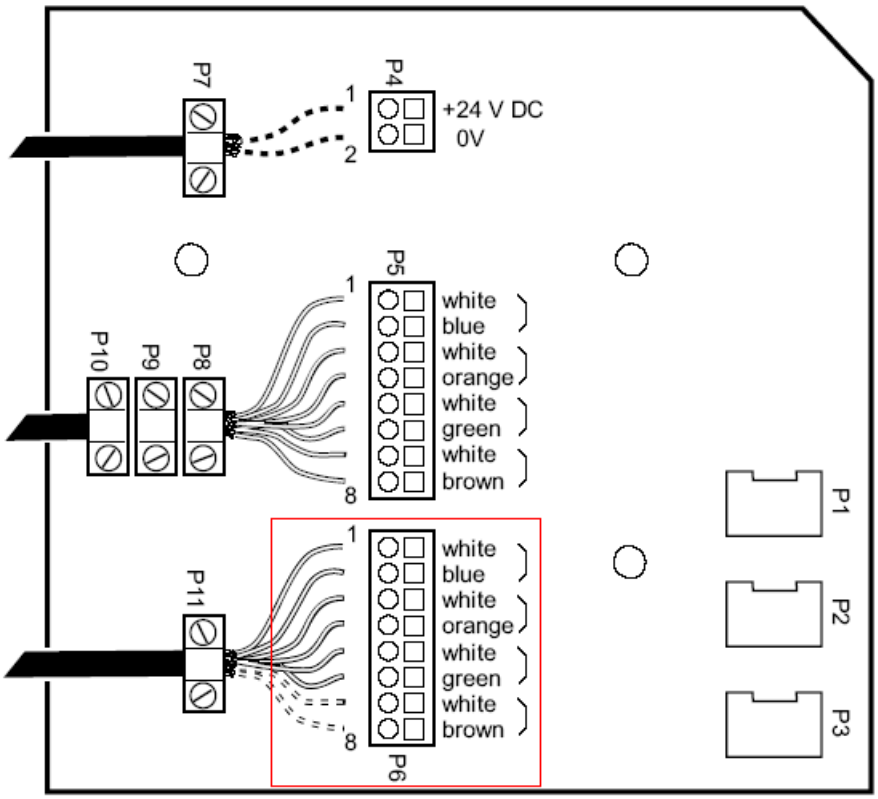


Figure 5.4 shows the ports on the RGPS antenna

Figure 5.4 Ports on the RGPS antenna

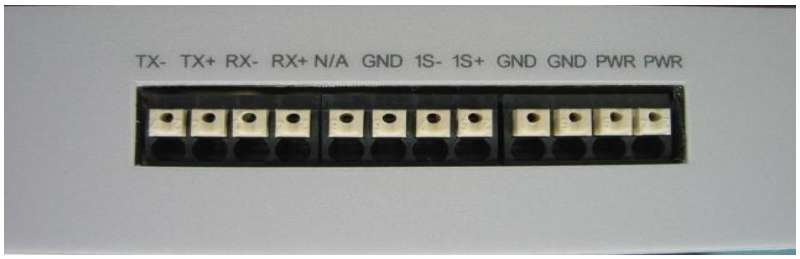


Table 4.1 list the connection relationship between the RGPS cables and the ports on the DGPS panel.

Table 4.1 Connection relationship between the RGPS cables and the ports on the DGPS panel

Silkscreen of Ports on the DGPS Panel	Color of Competitor's RGPS Cable	Description
TX-	Orange	Input port of serial signals from the DTMU to the RGPS antenna
TX+	Orange and white	
RX-	Blue	Output port of serial signals from the RGPS antenna to DTMU
RX+	Blue and white	
1S-	Green	Output port of 1PPS signals from the RGPS antenna to DTMU
1S+	Green and white	
GND	Brown	Power grounding
PWR	Brown and white	Power supply

5.3 BOM List of DGPS Antenna System

For the BOM list of DGPS antenna system, refer to the attachment below:

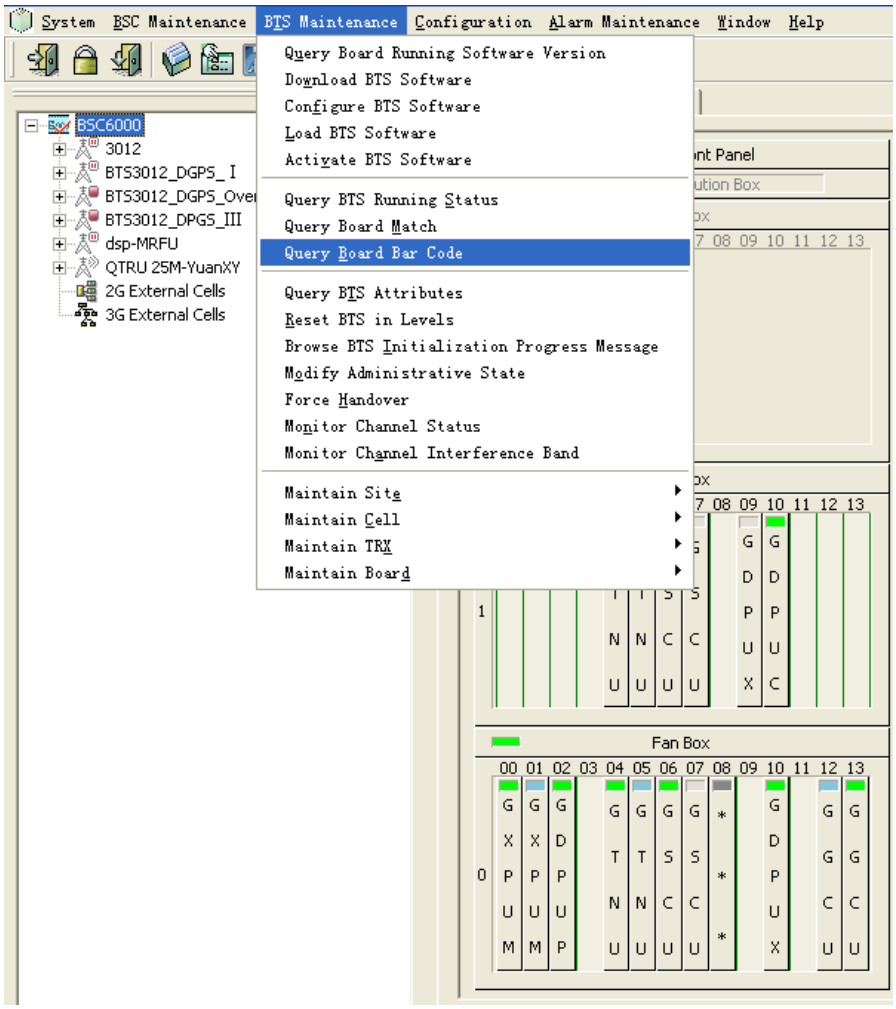
5.4 Identifying the Type of Receiver Remotely

To identify the type of receiver remotely, query the BOM contained in the bar code of DGPS board.

Query the bar code of DGPS board as follows:

Step 2 Log in to the BSC6000 LMT and select **BTS Maintenance > Query Board Bar Code**, as shown in Figure 1.1.

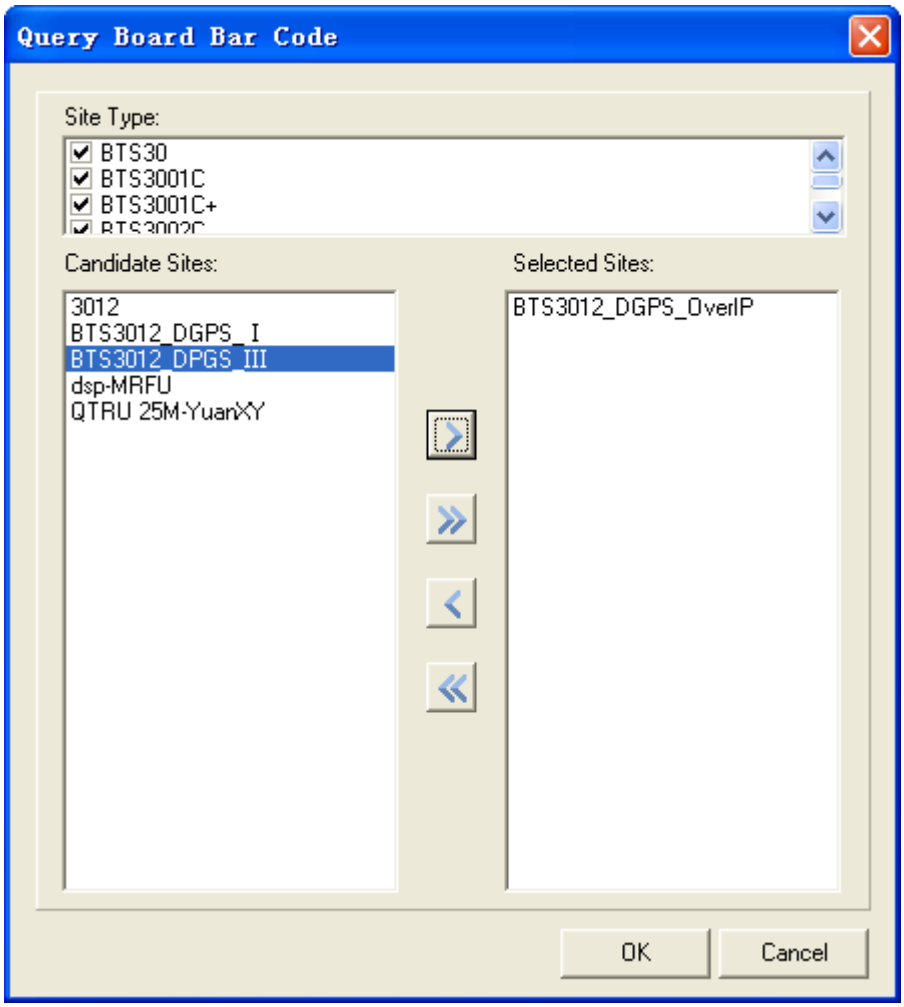
Figure 1.1 Querying bar codes of boards



Step 3 Select site types in the **Site Type** area, and the candidate sites complying with the selected site type are displayed in the **Candidate Sites** area.

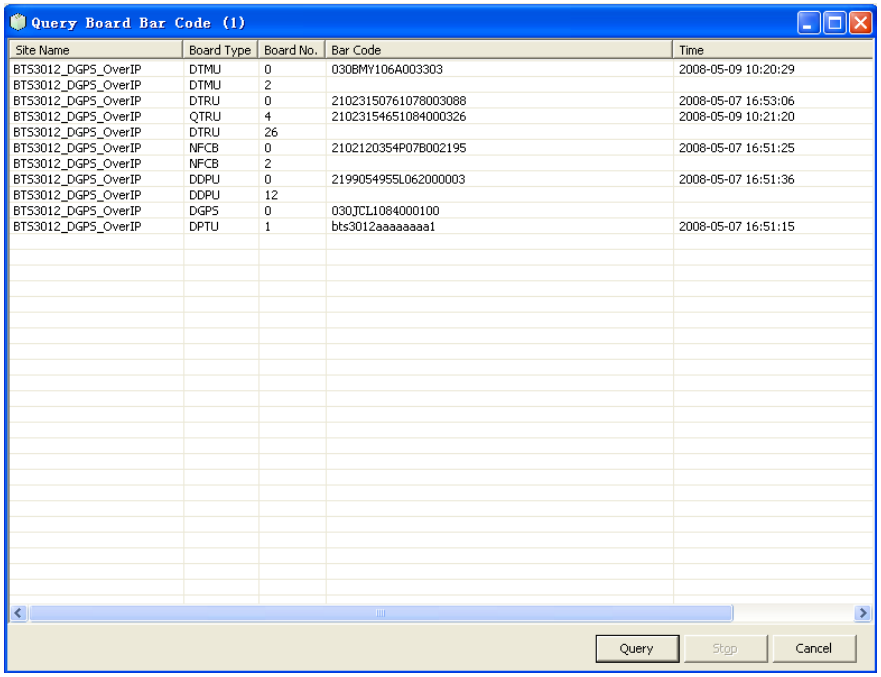
Click > to add a site to the **Select Site** list. Click >> to add all the sites in **Candidate Site** list to the **Selected Sites** list. On the contrary, you can click < or << to move the sites in the **Selected Sites** list to the **Candidate Sites** list, as shown in Figure 1.1.

Figure 1.1 Querying bar codes of boards-selecting sites



Step 4 After selection, click **OK**. A **Query Board Bar Code (1)** box is displayed, as shown in Figure 1.1.

Figure 1.1 Result of Queried bar codes



In Figure 1.1, the bar code of the DGPS board is 030JCL1084000100, of which the first six digits (letters) is the BOM, 030JCL. For details about the relationship between BOM and the receiver types, refer to Table 3.1.

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